Wetlands of Island County, Washington
Profile of Characteristics, Functions, and Health

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For questions or comments regarding intended use of information in this report, please contact Jeff Tate (Assistant Director, ICPCD). For technical questions, the principal investigator (Dr. Paul Adamus) may be contacted by email at: adamus7@comcast.net.

Summary

This document partially addresses the Wetlands component of Island County's Critical Areas Ordinance (CAO). It presents the results of a year-long collaborative project to compile, analyze, and summarize existing data pertinent to Island County wetlands. Similar in concept to the "report card" issued periodically for Puget Sound[1], this compilation attempts to describe the health[2] and probable functions of Island County wetlands, as one basis for determining what, if any, modifications are needed to the CAO's wetlands regulations[3]. As such, it represents one component of Best Available Science (BAS) for wetlands as required and defined by WAC 365-195-900 through 925 and described in the *Critical Areas Assistance Handbook* (CTED 2003).

This project described in this document compiled and statistically correlated data for over 1000 characteristics (Appendix B) of Island County's 958 known wetlands. Spatial data (maps) from many existing sources were overlaid and analyzed using computerized tools at four scales: wetland, contributing area, surrounding area, and watershed (basin). A wetland's "contributing area" is the geographic area from which surface water drains to the particular wetland, and is a particularly relevant way of predicting the wetland's water regime and water quality. A wetland's "surroundings" were defined to include areas at various distances up to 300 ft around each wetland (see p. 61).

An especially important component of this project is that new data were collected from 103 wetlands that were visited over a 6-month period in 2005 and which represent about one-third of the County's wetland area. The collected field data are considered generally representative of Island County wetlands because the assessed wetlands were chosen according to a rigorous statistical design implemented by a professional statistician (see Appendix C1). The assessed wetlands are a spatially-balanced, statistically random sample of the County's approximately 13,429 acres of known wetlands. Over 2100 landowners surrounding 284 wetlands were contacted in advance of the field work, and permission was requested for property access to collect on-site wetlands data. Among the landowners contacted, more positive than negative replies were received in response to the County's request for one-time property access. Data were collected on plant species composition, water regime, alterations, and many other items. These data are intended to serve as part of a baseline or benchmark against which future changes in the County's wetlands may be compared. The Washington Department of Ecology's *Western Washington Wetlands Rating System* also was applied to all the surveyed wetlands, and results were compared with those from wetlands assessed non-randomly by WDOE elsewhere in the region. In addition, information from over 720 of the County's permit files and on-site evaluation records were reviewed, as was information from historical accounts. Aerial photographs and satellite imagery covering multiple time periods were interpreted to identify alterations of wetlands, and results were compared with data from the field visits and permit files.

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[1] by the interagency Puget Sound Action Team (PSAT): http://www.psat.wa.gov/Publications/StateSound2004/State_Sound_Report.htm

[2] "wetland health" in this report is considered the same as "wetland ecological condition," "wetland quality," and "wetland integrity"

[3] For latest information, see: http://www.islandCounty.net/planning/caupdates.htm

Situated at a marine crossroads in Puget Sound, Island County is an unusually important concentration and feeding area for many fish and wildlife species, many of which depend on wetlands. Island County's wetlands are distinctive in that none occur along rivers or in river floodplains, and only about 22% of the non-estuarine ones are associated with streams. Of the remainder, most (78%) are in depressions, which makes them highly vulnerable to long-term buildup of some kinds of pollutants, whereas others are on slopes. While few in number, the largest wetlands are estuarine.[4] For many years, there have been no commercial-scale logging or peat-mining operations in Island County. Bogs on peat or muck soils are especially sensitive and consequently the WDOE (Hruby 2004) suggests they be assigned the highest level of protection. Considering areas within 100 ft surrounding the County's wetlands, the average slope in this zone among all wetlands is about 10%. Only a few of the County's wetlands are situated on the fringe of lakes. Manmade ponds are prominent, comprising at least 18-32% of the number of wetlands but only 1-3% of the total wetland acreage (mean size = 1.12 acres). Rather than wetlands having been created by those ponds, more than half of the ponds were excavated in areas that (based on soil type) probably already were wetlands. Ponds also were created by damming intermittent channels. Most such alterations occurred in the early and mid-1900's.

Approximately 2079 wetland acres (17% of the total wetland acreage) are not under the jurisdiction of County government because they are on federal lands or in the municipalities of Oak Harbor, Langley, or Coupeville. Wetlands and their buffers currently comprise about 16% of the area zoned as Rural, Rural Residential, or Rural Forest; 23% of the area zoned as Rural Agriculture, and 49% of the area zoned as Commercial Agriculture.

From the assembled data, this project sought to assess the effectiveness of the wetlands regulatory component in the currently adopted Critical Areas Ordinance. Questions were asked relative to the following areas:

- *Wetland Quantity*: How much wetland is there, how has it been altered, when, and by what?
- *Compliance*: When citizens apply for permits for regulated activities in wetlands and their buffer areas, how has the County responded?
- *Wetland Health*: What is the present health of the County's wetlands, and is it being maintained?

Wetland Quantity. Before non-indigenous settlers began arriving in numbers in the mid-1800's, Island County may possibly have had 22,574 acres of wetlands (17% of the County's land area), compared to 13,428 acres (10%) as of the mid-1970's, the most recent time for which a relatively comprehensive estimate is available[5]. Our review of the aerial photographs from 1985 suggested that very few areas[6] mapped as wetlands in the mid-1970's had been completely converted by 1998 to upland, and between 1998 and 2005 there was little further loss[7]. In addition, anecdotal accounts describe wetland conversions throughout Island County from the time of settlement up to at least the 1950's, mostly as a result of ditching, diking, pond construction, peat harvesting, and filling. Maps based on aerial photo interpretation from the mid-1970's show at least 22% of the County's wetlands at that time had been artificially altered, and that did not include major alterations such as logging and

[4] This study did not include areas mapped as estuarine by the National Wetlands Inventory if they lack emergent vegetation.
[5] from the maps of the National Wetlands Inventory, which were based on 1970's aerial photographs. No updating or verification was done by this wetland project.
[6] possibly wetlands # 533, 675, and 689, although those might have been erroneously mapped as wetlands by NWI. Their total mapped acreage is 5.35 acres, and all were outsite the County's jurisdiction (they are zoned Municipal).
[7] possibly wetlands # 97, 111, 120, 126, 559, and 612, although those might have been erroneously mapped as wetlands by NWI. Their total mapped acreage is 13.93 acres, of which only 7.41 acres were within the County's jurisdiction.

other vegetation clearing. Many former tidal marshes were cut off from tidal circulation by dikes and tidegates during the 1900's to provide farmable land.

New alterations to wetlands and their 100-ft buffers during the 1985-1998 period consisted of the following, based on interpretation of the aerial imagery. About 11% of the wetlands were partially altered by construction of at least one building during this period, or by a section of road or driveway, or clearing of woody vegetation. Portions of the 100-ft buffer zones of about 24% of the wetlands may have been altered by those activities during that period. During that same period, *recovery* from earlier alterations was apparent in 12% of the wetlands and 13% of the 100-ft buffer zones[8]. "Recovery" within the wetland or its 100-ft buffer consisted of the return of a forested or shrub canopy, filling in of bare areas by vegetation, overgrowth or removal of buildings or roads, and/or removal or creation of ponds (the last of these only questionably being considered "recovery").

During a shorter and more recent period (1998-2005) about 8% of the wetlands were partially altered by construction of at least one building, a section of road or driveway, or clearing of woody vegetation. Portions of the 100-ft buffer zones of about 8% of the County's wetlands may have been altered by those activities during that period. Although it appears there was a decline in detectable alterations to wetlands and their 100-ft buffers since the 1998 critical areas update (as compared to the earlier period), it is difficult to say for certain because the data from 1998-2005 covers fewer years (7) than the data from 1985-1998 (13 years). If a slowing of wetland alterations has indeed occurred, this might have been due to growing public awareness of the County's wetland regulations, increased enforcement, a changing economic situation, and/or other factors. It also is important to understand that many types of wetland alterations cannot be detected from aerial imagery. For example, changing water levels in wetlands cannot be reliably assessed from just two aerial photographs.

Considering the specific activities that occurred, aerial image analysis showed that road construction dropped from being added to 4% of the wetlands between 1985 and 1998, to being added to less than 1% between 1998 and 2005. The rate of new clearing dropped from occurring in 5% of the wetlands between 1985 and 1998, to occurring in 2% of the wetlands from 1998 to 2005. Building construction, however, increased from being added to 4% of the wetlands (1985-1998) to being added to 6% of the wetlands (1998-2005). In the 100-ft wetland buffers, the incidence of new road construction dropped between periods (8% vs. 3%), the incidence of new clearing dropped from being in 16% of the wetlands (1985-1998) to just 4% (1998-2005), and the incidence of new buildings stayed nearly constant, being 8% (1985-1998) and 7% (1998-2005). In virtually all cases during both time periods, the percentage of a wetland or its buffer occupied by new roads, buildings, or clearings was under 5%.

Although exact estimates of area converted from wetlands to uplands between 1985 and 2005 are difficult to interpret from aerial imagery (due to differences in quality of the imagery from those dates), it appears any loss of wetland acreage during that period would pale in comparison to the loss of at least 9146 acres of wetland prior to the mid-1970's, when wetland losses in Island County are estimated to have averaged at least 76 acres per year. This is further supported by data in the summary that follows.

Permitted Alterations and Ordinance Compliance: Over the 19-year period after the County's Wetlands Protection Ordinance was adopted (since 1984), permits issued by the ICPCD resulted in alterations to approximately 0.26% (34 acres, or about 1.8 acres per year) of the County's wetland acreage, and 0.49% (28 acres, or about 1.5 acres per year) of lands within 100 ft of wetlands. Compare

[8] Not all County wetlands are required to have a buffer of 100 ft, but to simplify the presentation of data this was assumed.

this 0.26% to complete conversion to uplands of possibly 41% of the County's wetlands prior to that time. Moreover, in at least 12% of the wetlands and 13% of the buffers, recovery of the wetlands or buffers from earlier disturbances was documented, following the 1984 adoption of the Ordinance. In a similar study in the Portland metropolitan area, the alteration rate of buffers within 328 ft of streams averaged 1-2% per year between 1990 and 1997 (Yeakley et al. 2005).

Our review of aerial photographs found alterations to 11% of the wetlands between 1985 and 1997, yet the permit files show changes occurring in less than one-quarter of the same wetlands during that period. This raises the possibility that some wetland alterations went unnoticed or were not authorized. A closer look at the permit files found that from 1985 to 1998, in the mapped wetlands there might have been 4 undocumented cases of clearing, 4 of road-building, and 1 of building construction. In the area within100ft surrounding the wetlands, there might have been 75 undocumented cases of clearing, 38 of roads or driveways, and 3 involving building construction. The large number of undocumented clearings was likely due to the fact that the WDNR database for timber harvests did not cover operations prior to about 1996.

Review of aerial photographs for the period 1998 to 2005 found alterations to 8% of the wetlands, yet the permit files document only about half the changes to these same wetlands. Specifically, from 1998 to 2005, in the mapped wetlands there might have been 4 undocumented cases of clearing, none of road-building, and 12 of building construction. In the 100-ft zone surrounding wetlands, there might have been just 3 undocumented cases of clearing, 1 of roads or driveways, and 14 involving building construction.

From the complete time period, 1985-2005, at least 16 of the seemingly undocumented or unauthorized alterations may have files at the Camano Office of the ICPCD that were not checked. In addition, there are many other possible explanations for the undocumented alterations, so no assumptions should be made about the legality of these changes. Some activities noticed in the aerial photographs may have been exempt from regulations, at least in the particular type of wetland or buffer in which they occurred. Due to lack of a Countywide digital map showing parcel boundaries, permit applications in ICPCD and WDNR files could not be matched exactly with changes noted from aerial photographs. The digital boundaries of wetlands and consequently their buffer zones also have unknown spatial precision, and in some cases a 50-ft rather than the uniformly-presumed 100-ft buffer was legal due to the wetland being a category B wetland. Even when the digital maps show wetlands to be present, field inspection by ICPCD staff or consultants of the particular parcel to which the permit application pertains may have determined in the field that that portion was not a wetland although shown as such on existing maps. Finally, in a few cases although application might have been made to the County for some of the activities noticed in the aerial photographs, files might not have been retained.

Another source of data on wetland alterations not covered by permit applications came from our field surveys of 103 Island County wetlands during 2005. As described in Appendix C3, the field crew noted various types of alterations within the wetlands and estimated (or asked the landowner) the time period when these occurred (ongoing, recent past, or distant past) and extent (<1% of wetland, 1-10%, 10-50%, >50%). "Ongoing" logging or other vegetation clearing which was not documented in ICPCD permit files or WDNR Timber Harvest files was noted in 2 wetlands, but in both was occurring in less than 1% of the wetland. "Recent past" (within about the last 20 years) clearing of vegetation that was undocumented in ICPCD or WDNR files was found in 3 wetlands, estimated to cover 10-50% of the wetland in one case and 1-10% in each of the 2 others. Again, valid assumptions cannot be made as to whether these activities were or were not legal or were exempt from CAO provisions.

Wetland Health. Although consensus does not exist in the scientific literature regarding what constitutes a high-quality or healthy wetland, we examined several characteristics that may reflect healthy ecological systems, or are used by other ecologists to represent that. Perhaps the most frequently-used indicator of wetland health is the predominance of native versus non-native plants. Degraded wetlands are often defined at least partially as being wetlands that have a predominance of characteristically invasive, weedy, or noxious species, and such species are almost always ones that are not native to the region. Many were intentionally introduced decades ago as forage for livestock or for horticultural use, but spread into wetlands. Non-natives are a concern because when they spread, they displace many of the uncommon native species and when this happens across many wetlands, the rarest native plant species can become extinct. Moreover, when the diversity of native plants within a wetland declines, it is logical to expect that use of the wetland by diverse invertebrate and wildlife communities would often be diminished. Lower richness of plant species in wetlands with greater spatial dominance of non-natives was confirmed statistically in our data from 103 Island County wetlands. The data also showed native vegetation (as a percent of overall cover) was greater in the wetlands that had the least physical alteration (of the types we could detect) and/or which had the most forest canopy in their buffers and contributing areas.

Overall, most Island County wetlands showed evidence of disturbances from the last century but presently appear to be in relatively good health. This project did not attempt to comprehensively inventory all plant species or communities in each wetland. Nonetheless, we found more than 20 native species in nearly half of the wetlands we surveyed, indicating the generally high diversity often associated with healthy systems. In 13% of the visited wetlands non-native emergent species were not observed, and in 65% of the visited wetlands non-native emergents were found but were not dominant in emergent parts of the wetland. Among 76 visited wetlands containing at least 5% woody vegetation, 24% had no non-native woody species at all, and 42% had non-native woody plants but none were dominant within wooded parts of the wetland. Considering both emergent and woody vegetation together, 11% of the wetlands did not contain non-native emergent or woody species, and 79% were not dominated by either, in terms of overall percent cover. This is comparable to the figures for native plant dominance within wetlands in other parts of Western Washington as surveyed by other researchers. Native emergent species also comprised an average of 79% of the species list of the visited Island County wetlands, compared to an average of 72% among wetlands in the only roughly similar survey in Western Washington. At least 8% of the wetlands we surveyed are bogs (an increasingly rare wetland type) or contain bog vegetation remnants. Considering just the 100-ft buffer areas around the wetlands we surveyed, about two-thirds had less than 20% cover of non-native plants.

Other indicators of wetland health might include scarcity of recent human **infrastructure or disturbing activities** within or near the wetland, and **high levels of function and value** relative to other Western Washington wetlands (as approximated by a rapid assessment method). The former actually is better characterized as a measure of risk rather than of impact, health, or quality. The latter paradoxically scores some functions higher in the most disturbed wetlands, so is also a poor indicator of wetland health or quality. However, some of the individual variables that it scores (e.g., connectivity) can, when considered alone, contribute to an assessment of a wetland's health.

To assess the first of these (infrastructure and disturbing activities), we examined aerial imagery from 684 non-estuarine wetlands (75% of the total). The sample was chosen randomly, and so is generally representative of non-estuarine wetlands in the County (see Appendix C5 for methods). This showed that as of 2001, 56% of Island County's wetlands had a disturbance score of less than 5 on a 0-10 scale, where 10 represents the most disturbance, and 45% have a score of 2 or less on that scale (see Appendix C5 for scoring details). Where the topography of wetlands had been altered by grading,

ditching, or mounding, our data showed that typically less than 22% of the wetland area had been involved.

Our field inspections of wetlands, although from a smaller random sample (n= 103) than the aerial imagery, allowed us to detect some types of changes not apparent in the imagery. The field data indicated that in 83% of the wetlands, less than 10% of the wetland perimeter is occupied by impervious surface, and only 19% of the wetlands have an upland edge with more than 10% lawn. In their 100-ft buffer, about 22% of the wetlands have roads or driveways, 21% have pasture or hayfield, 7% have other agricultural activities, and only 4% have buildings (some wetlands have multiple alterations). Overall, this sample of wetlands showed most to have relatively few detectable recent alterations.

The WDNR timber harvest database shows that since from about 1996 to 2004, approximately 12% of all wetlands in the County have had timber harvests authorized within 100 ft of the wetland boundary. Compared to 1998 conditions, aerial imagery from 2005 shows new clearing of vegetation within the 100-ft buffer of at least 4% of the wetlands, new roads in at least 1% of the wetland buffers, and new buildings in at least 7% of the wetland buffers. In nearly all cases these features occupied less than 5% of the wetland's buffer. County-designated "Critical Drainage Areas" are within the 100-ft buffer of 8% of the wetlands. Occupied buildings are within 150 ft of about half of the surveyed wetlands. Land cover maps derived from satellite imagery show "high-density developed area" occupying an average of just 2% of the contributing areas of the County's wetlands, and predominating in the contributing areas of just 1%.

Application of WDOE's Western Washington Wetlands Rating System suggests that most of the County's wetlands have characteristics that potentially allow them to purify mildly polluted runoff and provide habitat to a variety of wildlife species at a level comparable to wetlands elsewhere in Western Washington. Their average score for Water Quality Function is slightly lower than that for depressional wetlands elsewhere in Western Washington, but higher than for slope wetlands. Their average for Hydrologic Function is lower for both wetland types. Their Habitat Function score is about the same as a series of 122 wetlands assessed by WDOE in Western Washington. On the WDOE Rating System's four-category scale and based only on our sample of 103 wetlands, the number of the County's wetlands that fall in Category I (the highest) is 10%, in Category II is 29%, in Category III is 48% in Category III, and 12% in Category IV. By area, 9% fall in Category I, 48% in Category II, 41% in Category III, and 3% in Category IV. Compared to elsewhere in Western Washington, slightly fewer Island County wetlands are in WDOE Categories I and II, for which WDOE recommends the largest buffers and protection. However, comparisons with wetlands from elsewhere are very inexact because the Island County wetlands were drawn from a statistical sample whereas those surveyed elsewhere in Western Washington were hand-picked. Also worth noting is that in 12 trials comparing use of the Rating System by two trained persons assessing the same wetland, in 8 instances (75%) they independently arrived at the same category for the wetland.

The WDOE has proposed several approaches for calculating appropriate widths of buffers around wetlands. The buffer strategies are based on wetland category, adjacent land use intensity, and habitat score as calculated using the WDOE Rating System described above. One approach is based only on a wetland's assigned Category. As applied to our sample population of wetlands, this could result in a recommended buffer width of 225 ft for 30% of the County's non-estuarine wetlands, 110 ft for 56%, and 40 ft for 14%. A second WDOE alternative is based only on a wetland's score for Habitat Function. This could result in a recommended buffer width of 150 ft for 22% of the County's non-estuarine wetlands, and 100 ft for 78%. A third WDOE buffer strategy combines the assigned

Category with the score for Habitat Function. This could result in a recommended buffer width of 225 ft for 5% of the County's non-estuarine wetlands, 110 ft for 64%, 60 ft for 17%, and 40 ft for 14%. All the preceding figures assume a "moderate" impact from land uses in the buffer. Wider buffers could be expected if one of the most common buffer uses in Island County -- lightly-grazed pasture -- is considered a "high impact" use equivalent to industrial/commercial land use, hobby farms, golf courses, and residential densities of more than 1 unit per acre. Conversely, somewhat smaller buffers could be expected if lightly-grazed pasture, especially when accompanied by other best management practices implemented under a farm management plan, is considered a "low impact" use, as forestry operations currently are. Currently, under the County's current Wetlands Protection Ordinance, 86% (at most) of the County's wetlands have required buffers of 100 ft, and 14% required buffers of 50 ft (Rural zone) or 25 ft (other zones)[9].

Some of the indicators of wetland health that are most diagnostic could not be measured meaningfully by this project, and likewise have not been measured in surveys associated with CAO update requirements anywhere else in Washington. These include soil chemistry, sediment and water quality, long-term water table changes, flashiness of water levels in response to storm runoff, sedimentation rates, and reproductive success and usage of wetlands by fish and wildlife – especially the species most sensitive to human presence or specific types of habitat alterations. The degree to which these unmeasured indicators would correlate with the indicators that we did measure remains uncertain.

Potential Implications for CAO Changes. These include but are not limited to the following:
Question 1. Has the existing CAO succeeded in reducing the conversion of wetlands to uplands? (i.e., decreased the wetland losses)
Results From This Study: Wetland conversions in Island County prior to the CAO averaged at least 76 acres/year over a 120-year period, resulting in loss of about 41% of the County's wetlands (9146 acres). Since adoption of the original CAO in 1984, the ICPCD permit files show losses have averaged only 1.8 acres/year, resulting in alteration of 0.26% (34 acres) of the County's estimated wetland acreage (13,429 acres) between 1985 and 2005. Some additional alterations of wetlands are apparent in aerial imagery, but are much smaller than those that occurred before adoption of the original CAO. It cannot be determined how much of the credit for loss reduction can be assigned to the CAO directly, since economic factors, federal permitting requirements, and changing public awareness of wetland functions and values also might have played a role. It also cannot be determined if loss rates would have been more or less if the 1984 Ordinance had been crafted with slightly different provisions. Nonetheless, by most standards the recent wetland losses associated with the County permitting system would be considered proportionally small.

Question 2. How extensive are various *alterations* to the County's wetlands?
Results From This Study: Since the first settlers arrived, nearly all Island County wetlands have been logged, and most have experienced one or more of the following alterations: farming, peat extraction, filling (for roads, buildings, or other uses), excavation, ditching/drainage, or artificial damming. From 1985 to 1998, interpretation of aerial imagery showed that portions of about 11% of the wetlands were altered by new construction of at least one building, or by a new section of road or driveway, or new clearing of woody vegetation. Portions of the 100-ft buffer zones of about 24% of the wetlands may have been altered by those activities during that period. From 1998 to 2005, portions of about 8% of the wetlands were altered by construction of at least one building, a section of road or driveway, or clearing of woody vegetation. Portions of the 100-ft buffer zones of about 8% of the wetlands may

[9] Currently, categories (A or B) have been assigned tentatively to less than half of the County's wetlands. The percentages given here extrapolate from that limited and probably biased sample.

have been altered by those activities during that period. The WDNR timber harvest permit database shows that since about 1996, 7% of the wetlands and 12% of the 100-ft buffers have had timber harvests authorized. Many types of alterations, including some that are subject to regulation, could not be detected from aerial imagery or one-time field inspections.

Question 3. Despite the alterations, how many of the County's wetlands are in *good* or *adequate health* currently?
Results From This Study: It depends how "good" or "excellent" health are defined and measured. Unlike water quality standards for streams, there are no State, Federal, or County standards or criteria for what constitutes good or adequate ecological health for wetlands. Of many indicators that could be used to meaningfully assess this, only one has general scientific acceptance and was practical to apply in a consistent manner: the overall percent of the emergent vegetation cover that consists of native species. If one defines "good" to mean there is more cover of native than non-native emergent vegetation, our random sample of Island County wetlands shows 79% of the wetlands are in good health. This is comparable to the figures for native plant dominance within wetlands in other parts of Western Washington as surveyed by other researchers. If "excellent" health is defined as being, for example, more than 90% cover of native emergent vegetation, then 49% of the wetlands are in excellent health. It cannot be assumed that wetlands considered to be in good or excellent health (based only on the percent of their emergent vegetation cover that consists of native species) are also high-functioning, nor can high-functioning wetlands be assumed to always be dominated by native species.

Question 4. What *useful functions* do most of the County's wetlands perform?
Results From This Study: Although functions of wetlands could not be measured directly, this study's application of WDOE's *Western Washington Wetlands Rating System* suggests that most of the County's wetlands have characteristics that potentially allow them to purify mildly polluted runoff and provide habitat to a variety of species. Water purification is important to maintaining the quality of groundwater upon which County residents are entirely dependent, as well as maintaining the health of salmon streams, estuaries, and Puget Sound. By area, 22% of the County's acreage of non-estuarine wetlands overlies aquifers categorized as highly susceptible to contamination. Overall, the capacity of the County's wetlands for providing habitat is roughly comparable to that of wetlands elsewhere in Western Washington. Priority species listed by WDFW, the WDNR Natural Heritage Program, or the County that are strongly associated with Island County wetlands include great blue heron, bald eagle, osprey, western toad, and five rare plant species. Priority habitats associated with the County's wetlands include habitat for cavity-nesting ducks, wood duck nesting habitat, waterfowl concentration areas, shorebird concentration areas, bogs, and riparian areas.

Question 5. Regardless of their present health, what has been the *trend in the health* of the County's wetlands since adoption of the CAO? Are they getting better, worse, or staying the same?
Results From This Study: No previous baseline exists for the only practical indicator of wetland health – the percent-cover of native emergent vegetation – so trends in wetland health are currently impossible to determine. Results from this study help provide such a baseline for future reference.

Question 6. Do some of the provisions of the existing CAO provide little or no meaningful protection for the County's wetlands?
Results From This Study: Overall, the information compiled so far does not show any portion of the CAO to be extraneous to the goal of protecting wetland health as reflected by percent-cover of native emergent vegetation. Statistically-significant correlations in our wetlands data between the incidence of invasive non-native plants and agriculture and with residential development bolster the general

belief that some types of moderate- and high-intensity land use will continue to pose a threat to wetland health unless certain activities are carefully regulated. Based only on statistical correlation, there is a suggestion that for native emergent vegetation within a wetland, maintaining woody vegetation in a 150-ft buffer provides little additional benefit compared to maintaining it in only a 100-ft buffer. On the other hand, the data suggested that a 100-ft buffer may be preferable to a 50-ft buffer.

1.0 Introduction

1.1 Background

This document addresses the Wetlands component of Island County's Critical Areas Ordinance (CAO). Its approach is both descriptive and quantitative. It presents the results of a year-long collaborative effort to compile and summarize in a focused manner all existing data pertinent to Island County wetlands, as well as new data collected from a statistically random sample (described in Appendix C1) of the County's wetlands and their surroundings. This will be integrated with technical literature from wetland research generally and together will comprise Best Available Science (BAS) pertaining to wetlands of Island County. The BAS review published by the Washington Department of Ecology (WDOE) (Sheldon et al. 2005) is being used as a starting point for review of pertinent wetlands technical literature. This joint approach – critical review of technical literature and compilation of existing and new data specific to Island County – will result in specific decisions regarding possible changes in the wetlands component of the County's CAO.

The Washington State Growth Management Act (GMA) requires that cities and counties review, and if necessary revise, their development regulations as reflected most commonly in a Critical Areas Ordinance, at least once every seven years. Island County is required by law to complete such a review before January 2007. "Wetlands" is one component of the County's CAO. As described at: http://www.islandCounty.net/planning/caoupdates.htm , the others are:

- Critical Aquifer Recharge Areas
- Frequently Flooded Areas
- Geologically Hazardous Areas
- Fish and Wildlife Habitat Conservation Areas

Changes to CAO provisions have already been adopted for the first three of the above components, and the fourth will be addressed later in 2006. For the Wetlands component, the Island County Department of Planning and Community Development (ICPCD) and the Board of Island County Commissioners (BICC) agreed at a early stage that the most effective and reliable way to make recommended changes to the wetland CAO is to first evaluate the present health of wetlands within the County. With such information, judgment as to the effectiveness of the previous and current wetland regulations can be made. Changes to the wetland CAO will then be recommended to both the Island County Planning Commission (ICPC) and BICC with the underlying goal to protect the County's wetlands at a level that meets the BAS requirements of the GMA (RCW 36.70A.172) and is appropriate for Island County.

1.2 What Are Wetlands?

In designating wetlands for regulatory purposes, jurisdictions are required to use the following definition of wetlands from RCW 36.70A.030(20):
"Wetland" or "wetlands" means areas that are inundated or saturated by surface water or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. Wetlands do not include those artificial wetlands intentionally created from non-wetland sites, including, but not limited to, irrigation and drainage ditches, grass lined swales, canals, detention facilities, wastewater treatment facilities, farm ponds, and landscape amenities, or those wetlands created after July 1, 1990, that were unintentionally created as a result of the construction of a road, street, or highway. Wetlands may include those artificial wetlands intentionally created from nonwetland areas created to mitigate conversion of wetlands.

A perception is often voiced that if an area doesn't contain water, it can't be a wetland. However, science and more than three decades of legal opinions have supported the practice of designating areas as wetlands if they meet the above criteria. Wetlands can include areas that never have visible surface water so long as their soils (within 12 inches of the land surface) remain saturated for about two weeks and they meet the other criteria above. Wetlands include many -- but not necessarily all -- areas known locally as wet farmed meadows, wet prairie, wet pasture, subirrigated pasture, alder thickets, swales, riparian areas, aquatic weed beds, and kettles. However, not all of these are subject to the same legal requirements. The determination of whether an area legally qualifies as "wetland" and therefore is subject to specific agency regulations (i.e., a "jurisdictional wetland") must be made by a qualified wetland professional while inspecting the area at appropriate times of the year.

1.3 Project Approach

This document is the result of four major tasks that were completed during 2005-2006:

1. Compilation and GIS analysis of all existing spatial data layers that might contribute to an understanding of the functions and health of Island County wetlands;
2. Interpretation of satellite imagery and aerial photographs to identify obvious changes to wetlands during two time periods (1985-1998 and 1998-2005)[10], as well as current conditions;
3. Review of past permit files to document proposed or actual alterations of wetlands that were reviewed by ICPCD;
4. Application of the WDOE's *Western Washington Wetland Rating System (Revised)*, as well as surveys of dominant plant species and collection of other new data, during field visits to a geographically-balanced random sample of 103 Island County wetlands.

These tasks and the resulting document and databases are intended to provide the first Countywide assessment ever conducted of Island County wetlands, in terms of their past and recent alterations, current ecological health and level of function, and features that may differentiate them from wetlands

[10] 1985 was chosen as a reference year because the County's first wetland protection ordinance was adopted in 1984. 1998 was chosen as a second reference point because at the time of the study it was the most recent year for which suitable-quality airphotos were comprehensively available, and because the wetlands ordinance was updated then

regulated elsewhere in Western Washington. When combined with other information sources such data are crucial in determining how effective the County's regulations have been, and how (if at all) they should be changed.

Key aspects of the procedures used in this project are described in Appendix C. In summary, field data were collected by two wetland professionals -- Kirsten Harma and Chris Luerkens of ICPCD -- after training in project-specific protocols by Paul Adamus, who also participated in collecting data in about 10% of the visited wetlands. Kirsten Harma and Dr. Adamus had previously attended a WDOE training session in the use of the *Rating System*. GIS analyses were begun by Adam Flamatos and Joe Burcar of ICPCD, and subsequently were performed primarily by Anthony Boscolo and Mike Kershner of ICPCD with assistance under an interlocal agreement from Dr. Joshua Greenburg of the Skagit County GIS Department. Review of historical permit files was accomplished mainly by John Coleman of ICPCD. Aerial imagery was interpreted by Paul Adamus (1985-1998 images), Anthony Boscolo (1998-2005 images), and Kirsten Harma (LiDAR images). Dr. Donald Stevens of the Statistics Department at Oregon State University was responsible for sampling design. Joe Burcar of ICPCD provided day-to-day project management and assisted in several aspects. Guidance at a policy level was provided by Phil Bakke (ICPCD Director), Jeff Tate (ICPCD Deputy Director), and Keith Dearborn (Dearborn and Moss, PLLC).

1.4 Important Note About Data Limitations

Whether a particular area meets the above legal definition of "wetland" can be determined with certainty only by a qualified wetlands professional during an onsite visit at an appropriate time of the year. Nonetheless, key parts of this document had to rely on digitized wetland maps whose accuracy and precision has not been field- verified, and which in some cases had been created decades ago. It was necessary to use such maps simply because of the impracticality of field-verifying the boundaries of a statistically relevant sample of the County's wetlands, due to private property access restrictions and limited time and resources. ***Therefore, all references in this document to "wetlands" should be interpreted only as "possible" or "potential" wetlands until being field-verified.*** This reliance on data from the best available wetland maps is no different than what nearly all jurisdictions do, and few have better maps than those that cover Island County.

This report includes data compiled from some Island County wetlands that are not subject to regulation by County government, such as those within city limits (Oak Harbor, Langley, Coupeville) or on federal lands, and those that are smaller than a threshold size set by the County's existing wetland ordinance (1/8, ¼, or 1 acre depending on their zoning category). These wetlands were included in order to provide a geographically comprehensive analysis.

When developing this document extensive use was made of Geographic Information Systems (GIS) - basically, computerized analysis of maps and associated tabular data. Many digitized maps (data layers) that we used were obtained from sources external to the ICPCD. Their data covers varied time periods and degrees of spatial precision, and typically have received little or no field-verification. The process of converting different maps to a common scale and overlaying them, as we did for this project, also has the potential to introduce some spatial errors. Thus, although we consider the spatial data and analytical methods we used to be the best available, no warranty is made regarding the absolute accuracy or precision of maps and data resulting from this effort. Suggested corrections and additions are welcomed.

2.0 Natural Processes Sustaining Wetland Functions and Health

Wetlands are important in Island County for several reasons:

- **Provide Habitat**: Wetlands can provide habitat for plants, fish, and wildlife that thrive in few other habitats, including several species that are of commercial importance or that are endangered, threatened, highly sensitive, or declining regionally;
- **Detain:** Wetlands can detain water and release it slowly to soils of downslope farmlands and channels, thus helping maintain soil moisture and limiting the intrusion of salt water into aquifers and streams connected to estuaries;
- **Purify**: Wetlands can purify water before it reaches streams, lakes, aquifers, and estuaries;
- **Stabilize**: Wetlands can dampen severe runoff that follows storms, thus minimizing channel erosion;
- **Beautify**: Wetlands can provide open space and natural vistas important for maintaining residential property values, tourism, and recreational opportunities.

Most of these functions have never been measured directly in Island County wetlands, but are inferred from studies of wetlands in similar areas. Typically, wetlands perform most of these functions to a greater degree than do upland areas of comparable size. Yet not all wetlands perform these functions to an equal degree. Distinguishing which wetlands or wetland groups ("complexes") are of greatest importance to a particular function, or to all functions combined, is not a simple matter. For example, one cannot assume that "wetter" wetlands are universally more important than "drier" wetlands, that estuarine wetlands are inevitably more valuable than freshwater wetlands, or that wetlands overrun by non-native weeds are automatically less functional than ones with a diverse assemblage of native species. In reality, all these factors and many more must be integrated when attempting to identify the most important wetlands, in terms of both their functions and health. Some of the factors important to determining the levels of specific functions and values have been incorporated into the WDOE's *Washington State Wetland Rating System for Western Washington (Revised)* (Hruby 2004) and are listed in abbreviated form on page 76. But these do not automatically equate to wetland health. More comprehensive discussions of wetland functions, their economic importance, and the factors that predict them are provided by Adamus et al. (1992) and Sheldon et al. (2005).

At the most fundamental level, the major wetland functions are supported primarily by several key natural *processes*, which are dynamic physical, biological, and chemical interactions. These form and maintain both wetlands and the watersheds in which wetlands exist. They are defined by spatial and temporal patterns in the delivery, movement, and loss of:

- Water (e.g., infiltration, recharge, discharge)
- Sediment
- Chemical elements and compounds
- Aquatic organisms (bacteria, algae, invertebrates, fish)
- Detrital material (wood, dead herbaceous plants).

The main drivers or mediators of these movements are precipitation, topography, vegetation, soils, and surficial geology. If one could identify the specific portions of watersheds where wetlands -- because

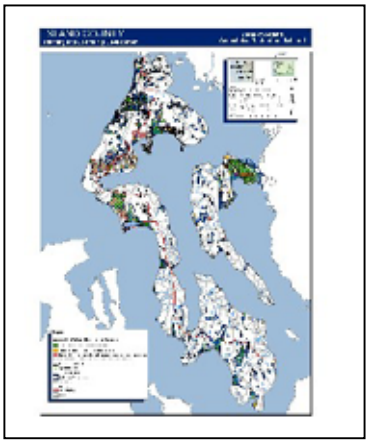
of their position and type -- are most critical for maintaining these processes or being maintained by them, that would go a long way towards protecting the functions of both the wetlands and their watersheds (see the WDOE report, *Protecting Aquatic Ecosystems: A Guide for Puget Sound Planners to Understand Watershed Processes*, Stanley et al. 2005).

In a few cases, existing data layers for Island County identify areas in each watershed that support key processes, such as aquifer recharge. Whenever possible, in this document we have overlaid maps of wetlands with "key process" maps to synthesize data that will allow identification of the associated key wetlands. However, for most watershed processes, accurately and sensitively discerning key areas with data layers currently available for Island County would be a daunting task. As a first step towards accomplishing this in the future, we have used a Countywide overlay of *watersheds* (basins) when compiling all spatial data layers potentially relevant to wetlands. In the databases accompanying this report, we have dynamically segmented the wetlands within each of the watersheds. That is, using identifier codes for individual wetlands, we identified which wetlands are located upslope from which other wetlands within the same drainageway or watershed, and have noted their relative elevations and the nature of their actual or possible connection, e.g., stream channel, hydric soil. However, possible groundwater connections among wetlands could not be determined with certainty without field measurements and complex computer modeling.

Paradoxically, wetlands in Island County, as elsewhere, require some degree of disturbance in order to remain healthy, adaptive, and high-functioning. Natural disturbance can include occasionally-extreme floods and droughts, and occasional partial removal of vegetation by wildlife, windstorms, salinity incursions (into freshwater coastal wetlands), and fires. Long before the County was settled, glaciers, beavers, and landslides created a few of the wetlands by blocking segments of the small streams that were present. Most types of moderate disturbance allow wetland plant communities to become more diverse. Drought that exposes wetland sediments to the air also accelerates the cycling of many elements, thus increasing wetland productivity over the long term. In contrast, maintaining wetland water levels at a constant level minimizes disturbance to such a degree that it can eventually lead to stagnation of biological communities in some types of wetlands (Magee & Kentula 2005). Bogs may be an exception. Despite the requirement for some kinds of occasional minor disturbances, if disturbance within wetlands is prolonged or severe -- such as resulting from many drainage ditches, dikes, dams without control structures, soil compaction, severe erosion, chronic sedimentation, or contamination by persistent toxins -- the long-term effects on most functions, and consequently the services wetlands deliver to society, will be detrimental.

3.0 Quantitative Profile of Island County Wetlands

3.1 One Basis for Creating a Wetlands Profile: Map Synthesis



Building a profile of a region's wetlands first requires compilation of the best available spatial information on wetland locations and boundaries. Estimates of the total acreage and boundaries of wetlands in Island County depend on the source. In order to ensure that maps we used in subsequent analyses were the most comprehensive, we combined three sources:

- National Wetland Inventory (NWI) from the mid-1970's
- ICPCD wetlands maps that mostly were adaptations of the NWI maps
- Individual wetland delineations and field notes associated with ICPCD permit applications since 1985

These spatial data were overlaid using GIS as detailed in Appendix C4. Where overlaps occurred, the largest combined outer boundary was used to create a new "composite wetland polygon" and any boundary lines within the polygon[11] were dissolved. Where NWI and ICPCD polygons overlapped, the average overlap was 35% prior to creating the composite polygon. Estuarine areas mapped by NWI, but which had no codes for emergent or shrub vegetation, were excluded because they seldom meet standard criteria used in wetland delineation. For example, mud flats shown on NWI maps were not included. A total of 958 composite wetland polygons were delimited and each was assigned a unique identifier number. Non-estuarine wetlands from Island County or NWI wetland maps have identifiers in the 1-999 range. Most wetlands in the 1000 series were digitized from wetland delineation and/or field notes in ICPCD historical permit files. Wetlands in the 2000 series are ones that are estuarine. The resulting County-wide acreage figures are shown in Table 1.

Table 1. Extent of Island County wetlands as represented by various sources

Mapping Source:	Acres	% of Island County land area	# of polygons
Composite wetland polygons	13,429	10%	***958***
NWI maps only	6,463	5%	204
ICPCD maps only (including polygons added in Spring 2005)	11,623	9%	361
Overlap (both NWI & ICPCD)	4,657	4%	393

Field work by the author as well as ICPCD staff who review development permits indicate many wetlands are not shown by any of these maps. This is usually the case where wetlands that exist

[11] A polygon is any closed, two-dimensional figure that is bounded by three or more line segments, like a square, circle, or irregularly-shaped figure. On maps, polygons often delimit the boundaries of areas that are somewhat homogeneous with regard to a particular characteristic, such as wetlands generally or wetlands of a particular type.

beneath forest canopies cannot be detected simply by viewing aerial photographs, which is how all of the NWI wetlands had been mapped. To partly compensate for this, we added to the existing maps about 250 wetland polygons (mostly forested wetlands) that had been at least partially field-verified by ICPCD permit review staff. These 250 wetlands had not been shown on maps previously. From the original wetland maps produced by the NWI, these wetlands (the majority of which were discovered only during field visits that were part of the permit review process) increased the number of wetlands from 597 to 958 and the total area of wetlands from 11,120 to 13,429 acres.

Additional unmapped wetlands are probably most likely to exist where hydric soil occurs in flat terrain on fine-textured soils beneath the County's dense woody vegetation. Based on the soils information from NRCS for Island County, there are about 456 acres of such conditions where wetlands have not been identified but hydric soils that may support wetlands exist. If under similar conditions we include soils that are non-hydric but sometimes have hydric inclusions, and assume that some low-density developed areas may also have undetected wetlands, the acreage figure for undetected wetlands rises considerably. Such errors of omission also could be compensated for, and zones of likely wetland occurrence mapped, by using GIS analyses in conjunction with a statistical modeling process. Errors of commission – that is, mapped composite wetland polygons that actually are not wetlands – are also a concern but could not be estimated by this project. We did, however, note at least 68 instances of composite polygons being in obviously the wrong place, e.g., shifted dozens or hundreds of feet in one direction from where our field observations or aerial photographs showed a wetland to actually exist. In addition, ICPCD permit files occasionally contain notations that professional wetland delineators had determined that particular parcels within a mapped wetland polygon had been determined to not meet wetland criteria. We also found this to be true while visiting one of the 103 wetlands we assessed during 2005.

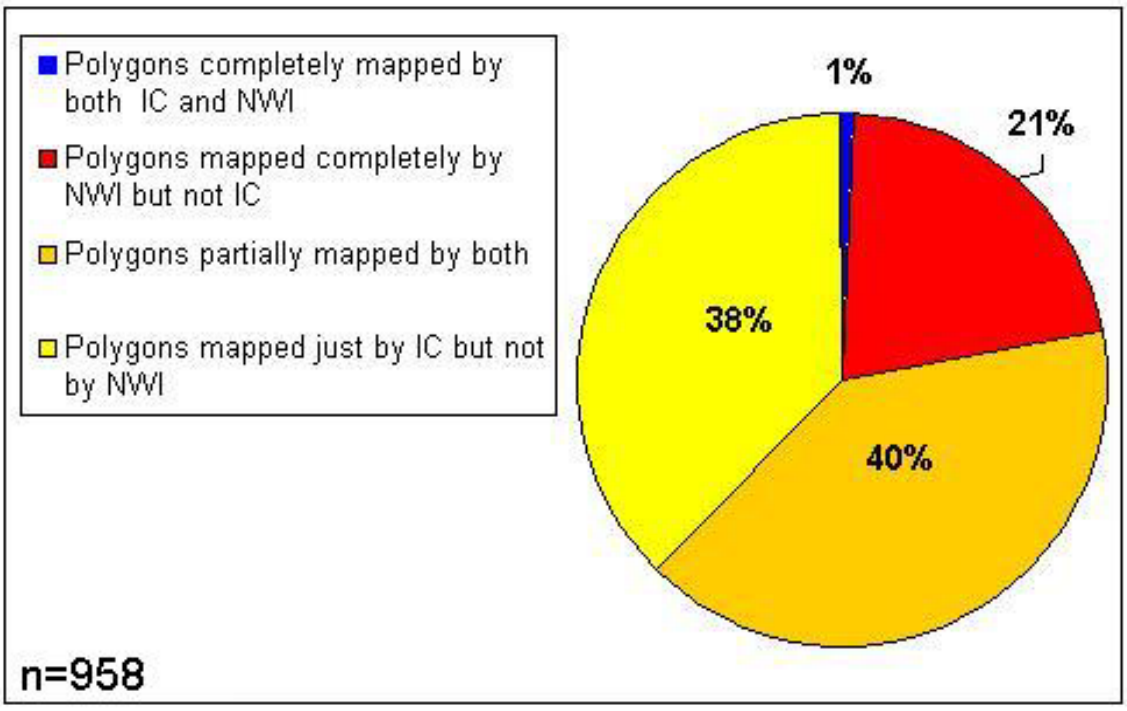


Figure 1. Degree of overlap between the original ICPCD wetland maps and the NWI wetland maps

3.2 Wetland Characteristics

3.2.1 What Differentiates Island County

A characteristic of Island County wetlands that distinguishes them perhaps the most from wetlands in other counties is that none occur along rivers or in river floodplains. This is due to the County's complete lack of rivers as well as the scarcity of perennial streams. Most of the County's wetlands were formed in depressions that were left in glacial sediments. Only 22% of the County's wetlands are connected by surface water to mapped streams or estuaries. Those that are not are likely connected to varying degrees by subsurface flow. In the northern part of Whidbey Island, there once were many wetlands called "kettles" – depressional wetlands surrounded on all sides by steep topography, with no surface water inlet or outlet, and often of importance as amphibian breeding sites. Only one permanently-flooded kettle remains – Pondilla Lake – and is protected as part of the Ebey's Landing National Historic Preserve. Some seasonally flooded kettle wetlands with gentler topography are present in northwestern Whidbey Island. Few lakes of any size are present in the County[12], so there are few lacustrine (lake fringe) wetlands. However, many wetlands include manmade ponds, and those portions of the wetland are not necessarily subject to the same County regulations. NWI maps suggest the number of wetlands that contain artificial ponds may be as many as 183, or 31% of the total. The NWI maps, because they are based on mid-1970's aerial photography, imply that most of these ponds were created prior to the 1980's. Soils maps indicate they were largely created in existing wetlands by excavation or by placing berms or roads perpendicular to intermittent streams and swales. Their median size is 1.2 acres. Unlike ponds, most of the County's wetlands do not remain wet year-round. This is evidenced partly by the data in Figure 2.

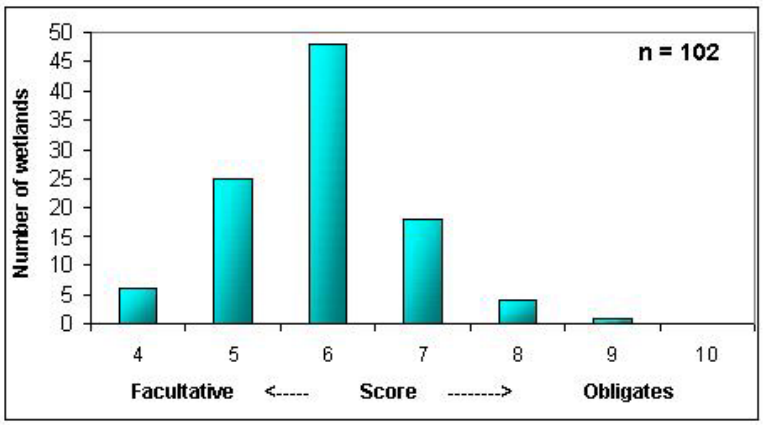


Figure 2. Moisture coefficient (average among plant species found) for Island County wetlands surveyed in 2005

Note: Plants that are "obligates" (score 10 for moisture coefficient) occur only in wetlands. Those called "facultative" (score 5) occur in both wetlands and uplands. Thus, among the statistical sample of 102 wetlands assessed by the ICPCD field crew, the large proportion of wetlands whose plants had average moisture scores of 6 and lower substantiates other data showing that most of the County's wetlands do not remain wet year-round.

[12] Goss Lake, Lone Lake, Crockett Lake, Deer Lake, Kristoferson Lake, and Cranberry Lake are subject to provisions of the Shoreline Management Act. An additional 3 water bodies recognized as lakes are present in the County.

3.2.2 Wetland Size and Position on the Landscape

The size distribution of the composite wetland polygons is shown by zoning category in Figure 3. Individually, estuarine wetlands are larger than other wetlands in the County and average about three times the size of non-estuarine wetlands. Depressional wetlands are about 60% the size of Slope wetlands. The average size of estuarine mapped wetlands is greatest in the Rural and Federal Land zoning categories, whereas the average among non-estuarine wetlands is greatest in Commercial Agriculture and Federal Land categories.

A significant number of wetlands are located in terrain which maps show as being sloping (Figure 4). Only 5% of the wetlands are in terrain that was measured from aerial imagery as having 0 percent slope; 42% are on slopes of 1-2 percent; 35% are on slopes of 2-5 percent, and 17% are on slopes greater than 5 percent. In a review of 696 LiDAR[13] images, 59% of the wetlands appear to be flat over at least 70% of their area, and 23% appear to be flat over less than one-third their area.

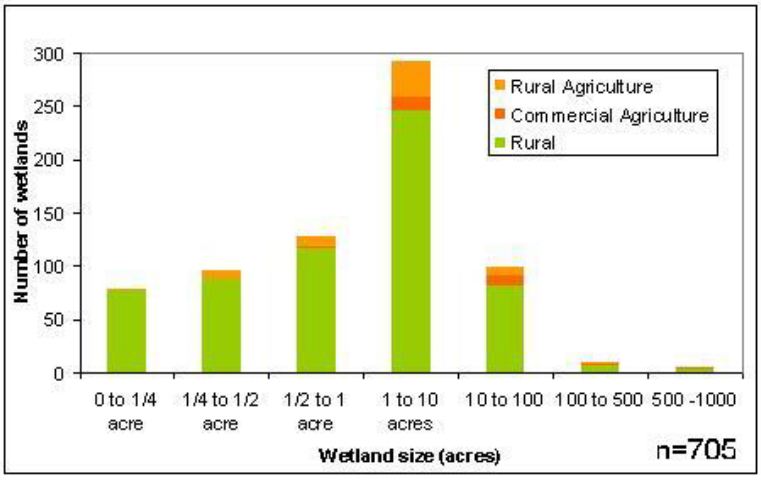


Figure 3. Size distribution of non-estuarine wetlands in Island County by zoning category (not all zoning categories displayed here)

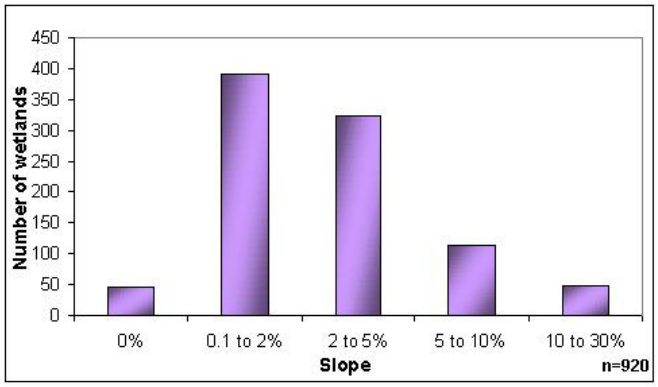


Figure 4. Mean percent slope of non-estuarine wetlands in Island County

[13] LiDAR, or Light Detection And Ranging, is a technology that detects the topography of the ground surface from an aircraft. Processed LiDAR images are available for the entire study area.

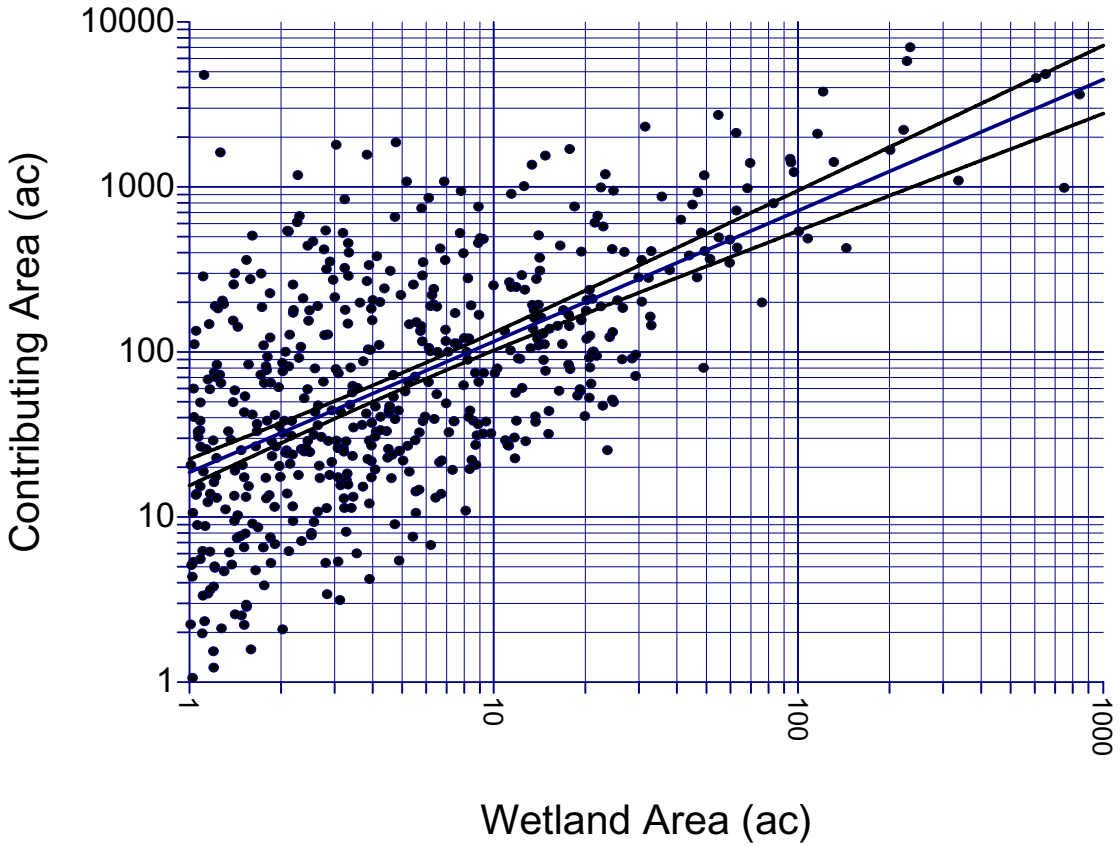


Figure 5. Relationship of wetland area to area of contributing basin for palustrine wetlands of Island County, based on GIS analysis of unverified wetland polygon boundaries

Note: Among all of the County's non-estuarine wetlands, the median ratio of contributing area to wetland area is 8.13, and the mean ratio is 15.85. With further analysis, graphs such as the one above may be used to identify which wetlands are being supported by groundwater vs. surface runoff, and which wetlands are likely to be most self-sustaining.

3.2.3 Connectivity Among Wetlands and Other Habitat

Based on stream maps provided by the WDNR, approximately 78% of the County's non-estuarine wetlands may be "isolated" from nearshore waters, i.e., apparently have no connecting stream. Of those non-estuarine wetlands that are connected via streams, the number believed to have sufficient year-round flow to be suitable for fish is unknown. Even streams with barriers and those that flow only seasonally can play a role in delivering foods used by fish (e.g., aquatic insects, detritus) to Island County's estuaries and nearshore waters where salmon and marine fish routinely find shelter. Connectivity with other habitats is described partly by some of the items used by the WDOE Rating System (Table 2).

Table 2. Number and percent of 83 visited non-estuarine wetlands having various buffer conditions and connectivity as estimated using the WDOE Rating System

	Buffer width and disturbance (a)	Corridors & size of habitat patches they connect to (b)	Proximity to other wetlands & condition of the connection (c)	All Three (d)
Excellent	31 (37%)	7 (8%)	18 (22%)	11 (13%)
Good	24 (29%)	38 (46%)	56 (67%)	23 (28%)
Fair	17 (20%)	38 (46%)	9 (11%)	40 (48%)
Poor	11 (13%)	0	0	9 (11%)

Terms in column 1 are not used by the WDOE System but were assigned based on the following

(a) scores of 4-5, 3, 2, or 0-1 respectively for item H2.1 in the WDOE Rating System form
(b) scores of 4, 2, 1, or 0 respectively for item H2.2 in the WDOE Rating System form
(c) scores of 5, 3, 2, or 0 respectively for item H2.4 in the WDOE Rating System form
(d) scores of >10, 8-10, 6-7, and 4-5 respectively for sum of the three items

3.2.4 Types of Wetlands (Classification and Categorization)

Wetlands can be classified in a variety of ways, and the most common of these is the scheme by Cowardin et al. (1979) that is used in the NWI and by most agencies. Table 3 and Figure 6 and Figure 7 use this scheme to profile the 63% of Island County's wetlands that NWI has mapped.

Table 3. Number of wetlands of various type by NWI classification.

Note: NWI maps show no more than 63% of the County's wetlands

	From the classification of Cowardin et al. 1979), NWI maps show at least part of the wetland mapped as:	# of Island County wetlands mapped by NWI	% of # of Island County wetlands mapped by NWI
System type	Estuarine	29	4.96%
	Palustrine	569	97.26%
	Lacustrine	1	0.17%
Class type	emergent	274	46.84%
	aquatic bed	65	11.11%
	scrub-shrub	179	30.60%
	forested	61	10.43%
	unconsolidated shore (i.e., open water)	11	1.88%
	unconsolidated bottom (i.e., open water)	219	37.44%
Hydroperiod type	temporarily flooded	93	15.90%
	saturated	7	1.20%
	seasonally flooded	279	47.69%
	semipermanently flooded	39	6.67%
	permanently flooded	263	44.96%
	artificially flooded	5	0.85%
	irregularly exposed (subtidal)	1	0.17%
	regularly flooded (intertidal)	22	3.76%
	irregularly flooded (supratidal)	16	2.74%
	seasonal tidal	5	0.85%
	temporary tidal	1	0.17%
	intermittently exposed non-tidal	1	0.17%

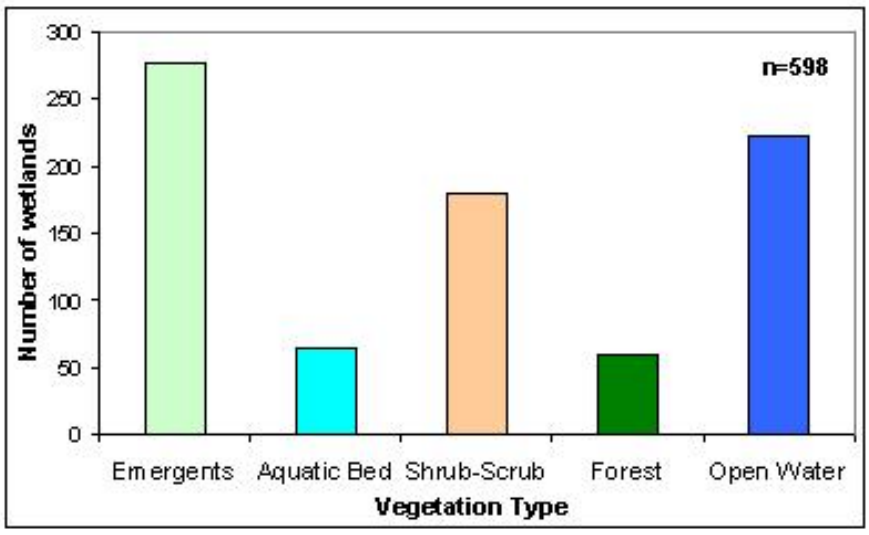


Figure 6. Frequency of classes mapped by NWI in Island County wetlands

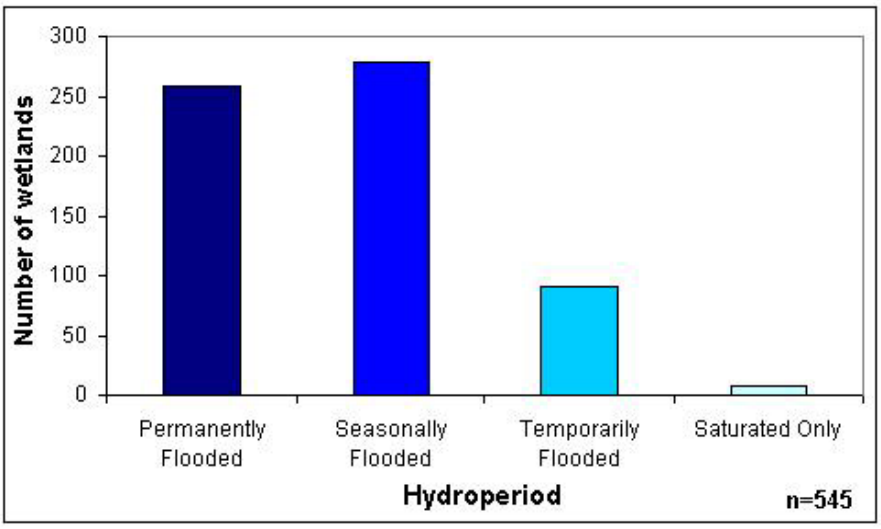


Figure 7. Frequency of hydroperiods mapped by NWI in Island County non-estuarine wetlands (a wetland may have more than one hydroperiod)

Another scheme for classifying wetlands that recently has gained popularity nationally (Brinson 1993) and has been adapted for use in Washington (Hruby 2004) is the hydrogeomorphic (HGM) classification. That scheme focuses more on a wetland's water sources and landscape setting than on its vegetation. Normally, site visits are required to determine the HGM class of a wetland. Those results are shown in the left half of Figure 8. But since we were able to visit only 103 of the County's wetlands, another strategy had to be used to assign an HGM class to the rest. To do this, available spatial data layers for slope and channel connectivity were examined using GIS. The preliminary results are depicted in the right half of Figure 8.

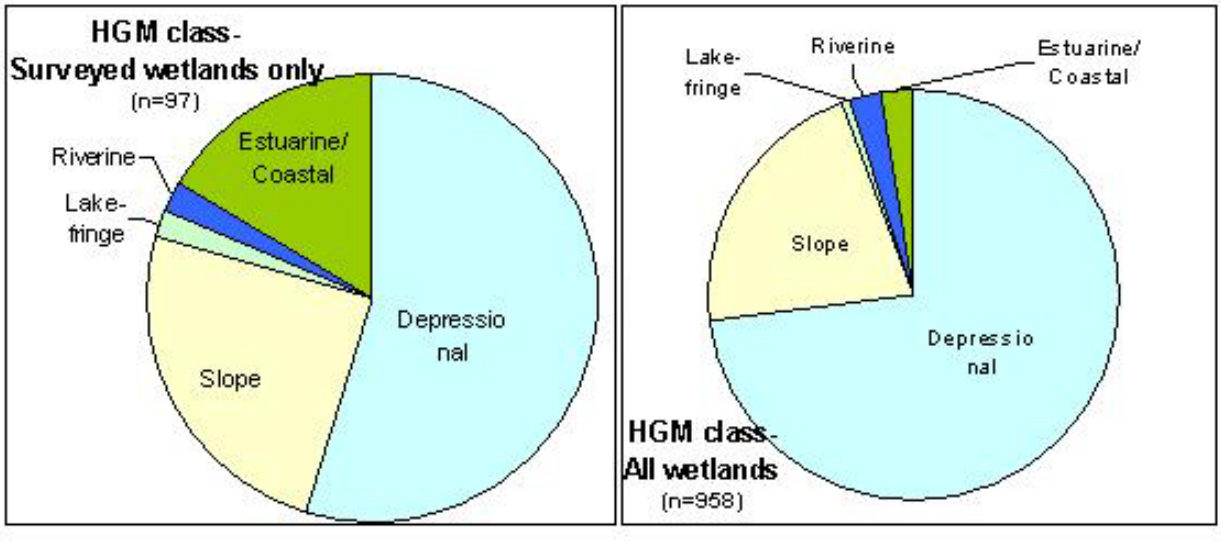


Figure 8. Number of Island County wetlands having various hydrogeomorphic (HGM) classes

	**Depressional**: Wetlands in low spots on the landscape. They include ponds, kettles and wet meadows (about 73% of Island County wetlands are in this category)
	**Slope**: Wetlands where groundwater discharges at the ground surface and flows down a slope (about 22% of all wetlands in Island County)
	**Lake Fringe**: Wetlands that are associated with lakes. (2% of Island County wetlands)
	**Salt Marsh**: Comprise 3% of the number of wetlands, but because of their large size comprise 8% of the acreage of wetlands in Island County
	**Coastal Lagoon.** Island County has more coastal lagoons than most other coastal counties in Washington, and these are regarded as particularly important foraging areas for marine and anadromous fish.
	**Artificial** wetlands created by human-related activities: Include farm ponds, seeps along irrigation canals, and wetlands from water backed up behind dams or berms. Many are exempt from regulations.

Figure 9. Examples of the diversity of wetland types in Island County

For regulatory purposes, Island County in the mid-1980s also adopted a categorization scheme for wetlands. The County uses a 3-tier wetland rating system, with categories A, B, and C (Table 4) tied by the ordinance to requirements for wetland buffer widths. As with the HGM classification scheme, application of this scheme to non-estuarine wetlands requires an onsite visit to a wetland to determine if its plant cover is dominated by non-native species. But since we were able to visit only 103 of the County's wetlands, we tentatively categorized the rest based on just their zoning category and size, except where ICPCD files contained the same categorical determination for most parcels in the composite wetland polygon, which then was used (Table 5).

Table 4. Regulatory categories of Island County wetlands included under the Critical Areas Ordinance, their associated buffer prescriptions, and approximate area protected

Category	Criteria	Zone	Minimum Size	Approx. % of all wetlands (number)[14]	Approx. % of all wetlands (acres)	Required Buffer Width	Approx. acres (wetlands + buffer)[15]	Approx. % of County land area (wetlands + buffer)
A	Estuarine wetland	any	any	3.34%	7.68%	100 ft	1307	0.99%
	Native vegetation dominates, OR protected species[16] habitat or presence	Rural	1/8 acre	54.49%	51.65%		9466	7.18%
		any other	¼ acre	26.30%	39.26%		6814	5.17%
B	Non-native[17] vegetation dominates	Rural	¼ acre	4.18%	4.88%	50 ft	388	0.29%
		any other	1 acre	5.64%	8.38%	25 ft	526	0.39%

Note: "Category C" wetlands are not shown due to lack of data. They are wetlands that were purposefully created where no wetland previously existed, such as ponds dug in upland areas. They are not regulated by the County.

Table 5. Number of wetlands by dominant land cover type in buffer zones of wetlands, within each ICPCD category (A, B, or C)

Note: Land cover determinations were based only on coarse-resolution (30 m cell size) satellite imagery from 1998. Categories shown in parentheses are for wetlands that were not visited and were not categorized previously by consultants or staff. Parenthesized categories were assigned based on the assumption that all those wetlands are dominated by native plant cover, therefore, if Category A wetlands are not so dominated, they will likely fall into Category B. Also, the pond portion of some wetlands counted in Category A or B may belong in Category C, if the pond was constructed in a non-wetland area.

	0-50 ft upgradient from wetland boundary						50-100 ft upgradient from wetland boundary					
IC Wetland Category:	A	B	C	(A)	(B)	(C)	A	B	C	(A)	(B)	(C)
Developed High Density	8	1	0	15	0	3	10	2	0	10	0	2
Developed Low Density w. Grass	0	1	0	5	0	0	0	2	0	4	0	0
Developed Low Density w. Shrub	9	3	0	12	0	1	7	2	0	8	0	1
Developed Low Density	24	2	0	16	0	8	20	2	0	16	1	9

[14] These are only estimates because categories cannot be assigned to non-estuarine wetlands without an onsite visit to determine if its plant cover is dominated by non-native species, and such an inspection has been made in all or part of only 54% of the County's wetlands. The remainder were *assumed*, only for purposes of this table, to be dominated by native plants.

[15] Excluding marine waters or lakes that fall within the buffer. Note that different parts of a single wetland may be assigned to different categories

[16] "Protected" species from the County's list that are likely to occur in wetlands: bald eagle, peregrine falcon, and 5 plants: *Agoseris elata, Cicuta bulbifera, Fritillaria camschatcensis, Morella (Myrica) californica, Puccinellia nutkaensis*

[17] Over 61 non-native species (17% of the County's wetland flora) occur in Island County wetlands (see Appendix D4) but the Ordinance lists only the following: *Iris pseudocorus repens, Juncus effusus* (erroneously), *Myriophyllum spicatum, Ranunculus repens, Phalaris arundinacea.* Our field data show that the following additional non-native wetland species (at a minimum) can dominate in non-estuarine wetlands of Island County: *Agrostis capillaris, Agrostis gigantea, Holcus lanatus, Solanum dulcamara*. Many non-native upland plants also invade portions of drier wetlands.

IC Wetland Category:	0-50 ft upgradient from wetland boundary						50-100 ft upgradient from wetland boundary					
	A	B	C	(A)	(B)	(C)	A	B	C	(A)	(B)	(C)
Forest Deciduous	2	0	0	1	0	2	0	0	0	3	0	0
Forest Evergreen Open	38	2	0	29	0	1	27	3	0	41	0	3
Forest Mixed	5	1	0	4	0	2	3	0	0	2	0	2
Forest Open with Shrubs	3	2	0	4	0	1	3	2	0	3	0	1
Forest Shrub & Grass	1	0	0	1	0	0	1	0	0	0	0	0
Grass Short	51	21	0	114	0	20	52	23	0	137	0	21
Grass Sparse	5	7	0	21	0	3	5	5	0	21	0	3
Grass Urban	2	0	0	10	0	0	3	0	0	9	0	0
Mowed	0	1	0	1	0	0	0	0	0	2	0	0
Open Water (shallow)	4	0	0	1	0	0	3	0	0	0	0	0
Open Water	5	0	0	0	0	0	10	0	0	0	0	1
Riparian Vegetation	3	0	0	3	0	0	0	0	0	0	0	0
Rural Lawn	19	3	0	30	0	14	26	4	0	28	0	8
Shrub-Ag Mixed	47	4	0	47	0	5	52	6	0	44	0	6
Shrub Deciduous	62	3	0	52	1	4	76	5	0	43	0	10
Shrubs- Evergreen	10	0	0	9	0	2	11	0	0	3	0	2
Shrub & Forest	42	0	0	24	0	4	38	0	0	34	0	1
Shrub & Grass	17	7	1	36	0	5	13	4	1	26	0	5
Shrubs Urban	3	0	0	0	0	0	2	0	0	1	0	1
Wetland (emergent estuarine)	2	0	0	0	0	0	1	0	0	0	0	0
Wetland (emergent non-estuarine)	2	1	0	1	0	0	1	0	0	4	0	1
Wetland (emergent & shrub)	6	0	0	4	0	0	5	0	0	4	0	0
Wetland (forested)	0	0	0	0	0	1	0	0	0	0	0	0
Wetland (shrub)	3	1	0	5	0	1	2	0	0	1	0	0

Table 6. Area and slope of wetlands categorized according to the current ICPCD criteria

Note: Parenthesized categories are for wetlands that were not visited or categorized previously by consultants or staff. Parenthesized categories were assigned based on the assumption that all those wetlands are dominated by native plant cover. Therefore, if Category A wetlands are not, they will likely fall into Category B. Category C wetlands are wetlands that were purposefully created where no wetland previously existed, and are not regulated by the County.

Category:	A	B	C	(A)	(B)	(C)
# of wetlands	373	60	1	446	1	77
Acreage sum	6445	696	0	6173	0	115
Acreage mean	17.28	11.60	0.09	13.84	0.09	1.49
Avg. Min. Slope @ 0-50 ft from wetland boundary	0.91	0.46	2.41	0.56	0.58	0.60
Avg. Max. Slope @ 0-50 ft from wetland boundary	33.63	25.07	26.43	27.21	10.66	23.09
Avg. Mean Slope @ 0-50 ft from wetland boundary	10.86	7.05	10.07	8.36	4.11	7.66
Avg. Min. Slope @ 50-100 ft from wetland boundary	0.76	0.39	5.11	0.52	1.00	0.61
Avg. Max. Slope @ 50-100 ft from wetland boundary	37.45	27.66	33.88	29.24	12.79	25.01
Avg. Mean Slope @ 50-100 ft from wetland boundary	11.43	7.43	16.25	8.71	5.57	8.32

More recently, several Washington counties have begun categorizing wetlands using the WDOE Rating System (Hruby 2004). Results of applying the WDOE Rating System to the 103 wetlands we visited are described beginning on page 73. Appendix D1 contains a tabulation of our data for individual wetland characteristics used by the WDOE Rating System, thus providing extensive additional profile information for Island County wetlands based on the geographically-balanced random sample of wetlands visited (Figure 10 and see Appendix C1).

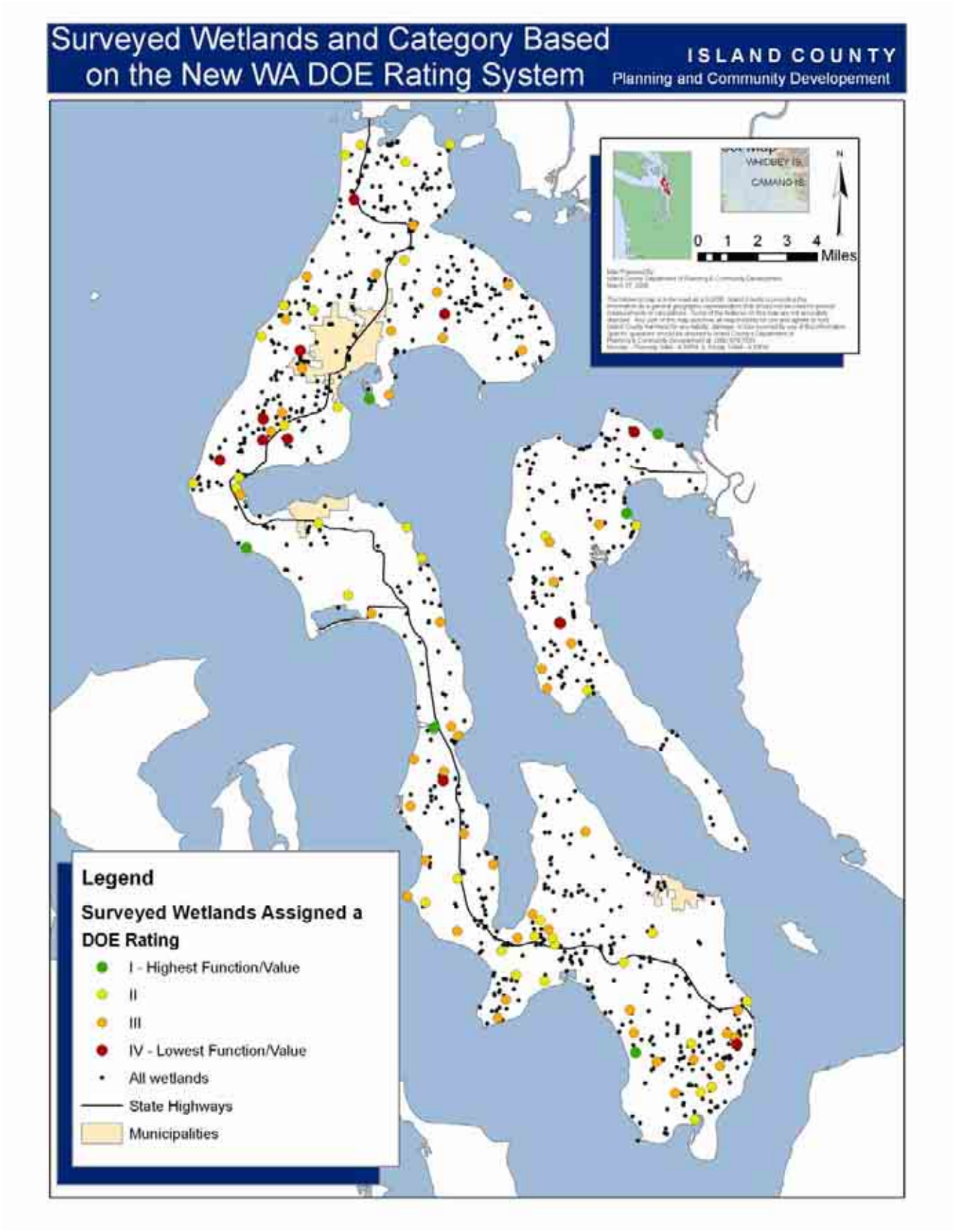


Figure 10. Geographic distribution of Island County wetlands surveyed in 2005

3.2.5 Wetland Soils

The numbers of wetlands found in various soil types is shown generally in Figure 12 and more specifically in Appendix D9. Wetlands by definition occur on hydric soils, yet NRCS maps show as much as 10% of the County's wetlands as having predominantly non-hydric soil. This is likely due to incorrect classification of the soil by NRCS or to incorrect mapping of the area as being a wetland. It is not possible without a site visit to determine which is the case. An additional 59% of the County's wetlands are mapped as having non-hydric soils, but are the types of non-hydrics that have a reputation for containing small hydric inclusions. Only 30% of the County's wetlands are dominated by truly hydric soils or water. By area, the most extensive soil types mapped as occurring in the County's wetlands are Whidbey gravelly sandy loam (Wb), followed by tidal marsh (Td) and coastal beach (Ch). In addition, Hoypus gravelly loamy sand (Hf) has a high frequency of occurrence. The NRCS maps show only 8 wetlands being dominated by a soil with a major clay component. Clay soils tend to be the most effective for adsorbing polluted runoff. Data from soil profiles taken in 2005 from the 103 visited wetlands, which would confirm the soil series that NRCS mapped in those wetlands, have not yet been interpreted.

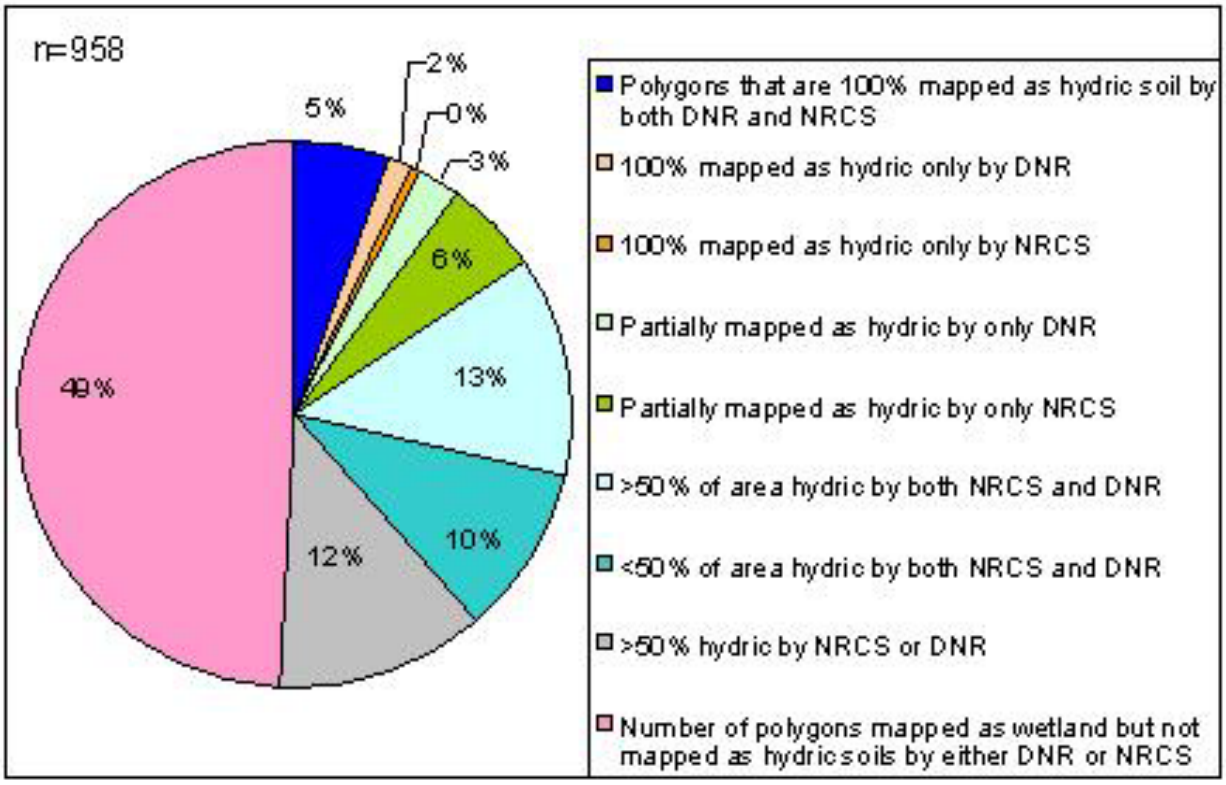
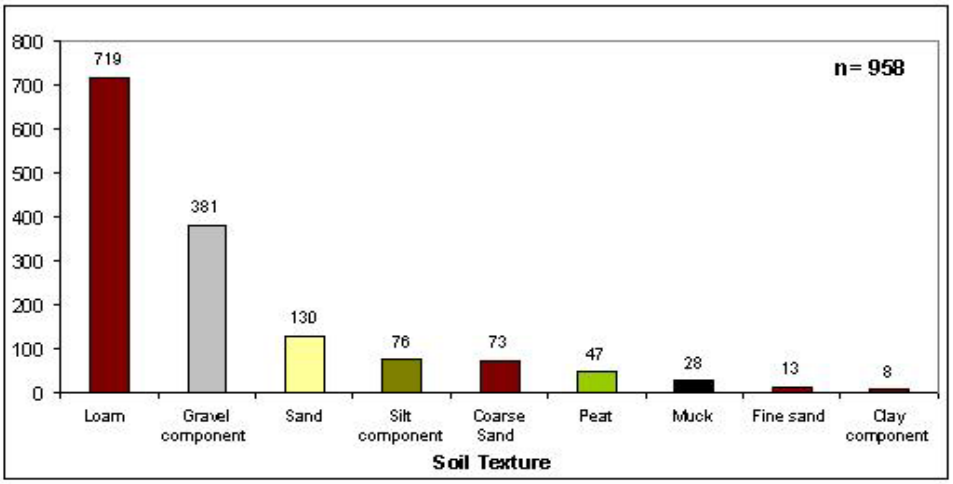


Figure 11. Comparison of hydric soil component of NRCS and WDNR soil digital layers for Island County wetlands

Spatial data from NRCS show that peat and muck soils, which typify present or former bogs, comprise 12% (by area) of the soils underlying the County's non-estuarine wetlands. Peat is mapped as being the *predominant* soil in 47 non-estuarine wetlands (5% of all non-estuarine) and muck in 28 (3%). Much of the peat has been extracted[18] and in many cases only the underlying mineral substrate and a pond remains. Vegetation characteristic of peat bogs (e.g., *Sphagnum* moss and/or various ericaceous plants) was found in 8 (8%) of the 103 visited wetlands, but was dominant in just 2. Of the 103 visited wetlands, 41 contained *Spiraea douglasii*, a native plant that occurs frequently but not exclusively on the edges of bogs and in former bogs. Based both on recent literature and the ICPCD visits to 103 wetlands, we classified 8 areas as being at least partially a bog at the present time, 4 as formerly-documented bogs that currently have no (or only small relicts of) bog vegetation, and 52 as possible bogs based only on their superficial appearance in airphotos taken in 1998 and on the NRCS-mapped presence of peat or muck soils.

Figure 12. Number of wetlands having each soil texture

Note: A wetland may have more than one type of soil texture.



3.2.6 Water Depth

Water depth is important to many wetland functions such as water storage and wildlife habitat. Among all of the visited non-estuarine wetlands with permanent water, the average percent of open water that would be shaded at mid-day was estimated as 35%. The maximum depth of flowing water in channels through wetlands, averaged among the 56 visited wetlands that contained some permanent surface water, was estimated as 2 inches during the driest time of year and 16 inches during the wettest (based on flood marks, topography, and vegetation). In stagnant areas the maximum depth was estimated as 39 inches during the driest and 63 inches during the wettest. When looking at all of the wetlands visited, most had no flowing water during any season, and there was a wide distribution of depths of standing water (Figure 13). In January 2006, return visits were made to 18 of the 103 wetlands assessed during the summer (Appendix D3), and we found in many cases that the seasonal change in water depth that was hypothesized during the summer visit

[18] Mining of peat is regulated partly by the WDNR. Permit files indicate that no new permits have been issued for over a decade, and ICPCD staff are not aware of any new permits being issued since the 1970's. Permits have been continued for operations that began on or before that time and have affected just three wetlands (#54, 243, and 313) which together comprise 75 acres. Oddly, none of these is mapped by NRCS as having peat soil, nor is recognized as a bog by the Washington Natural Heritage Program.

was significantly underestimated. During and immediately before January 2006 the precipitation levels in Island County were above normal for that time of year.

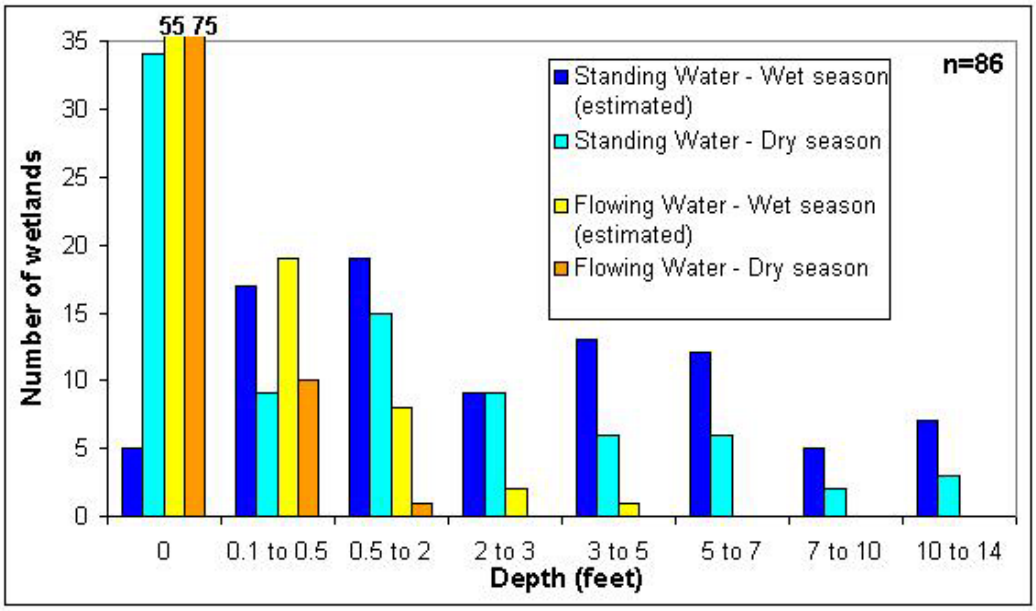


Figure 13. Water depth estimated in visited Island County wetlands

Note: About 33% of the wetlands had no surface water during the dry season visit. The portion of a wetland that is deeper than 6.6 ft throughout the year is generally not considered part of the wetland for purposes of applying wetland regulations.

3.2.7 Zoning Designations

The zoning designations and land use settings of wetlands potentially influences their health and functions. Conversely, the removal of lands from some economic uses in order to use those lands as buffers for wetlands has an economic and social cost. The extent of such removals in areas zoned partly or wholly for agriculture is shown in Table 7. Land use data are provided in Appendix D8.

Table 7. Percent of land with each zoning designation that now is protected as wetland, or potentially as a wetland buffer

Note: This shows, for example, that if a 100-ft buffer were applied uniformly to all wetlands within the Commercial Agriculture (CA) zone, the buffers plus the wetland protected would occupy about 48% of all the lands zoned as CA in Island County (last column, first row).

	In Wetland	Within 50 ft	Within 100 ft	Wetland + 50 ft	Wetland + 100 ft
Commercial Ag	42.60%	3.05%	4.72%	45.65%	48.53%
Rural Ag	16.69%	3.09%	6.32%	19.78%	23.01%
(Agriculture within Rural, Rural Residential, or Rural Forest)	10.86%	2.81%	5.40%	13.66%	16.25%
subtotal of above	18.09%	2.93%	5.74%	21.02%	23.83%
Rural Center	4.54%		0.46%		5.00%
Rural Village	3.14%		0.32%		3.46%
Rural Service	22.04%		0.06%		22.10%
Review District	3.14%		0.21%		3.35%
Park	8.82%		2.24%		11.06%
Airport	0.12%		0.01%		0.13%
Federal Land	25.05%		9.28%		34.33%
Municipality	3.17%		2.31%		5.48%
Light Manufacturing	22.59%		0.32%		22.91%

3.2.8 Landscape Settings and Wetland Importance

A wetland's location in the County can potentially influence at least two features of high concern: **pocket estuaries** (important for the wetlands they often contain and their capacity to support salmon and other fish) and **high-susceptibility aquifers** (vulnerable to contamination of ground water used for drinking). At least 696 wetlands comprising 10,763 acres (80% of the total wetland area) are in watersheds that slope downhill to pocket estuaries known to be heavily used by salmon and other fish (Figure 15). Although those wetlands cumulatively comprise an average of just 8% of the area of their watersheds, and not all are connected by streams to the estuary, some diffuse connections probably exist at least through lateral subsurface flow and groundwater, allowing them to potentially export carbon to estuarine food chains (Fitzgerald et al. 2003).

At least 228 non-estuarine wetlands (24% of all non-estuarine wetlands) comprising 2,408 acres (22% of the total area of those wetlands) are partially or completely "on top of" highly susceptible aquifers (Figure 14). When the contributing area of each wetland is also included, 41% of all non-estuarine

wetlands are found to have contributing areas that overlay some amount (mean = 32% of the contributing area) of highly susceptible aquifer. This emphasizes the link between ground water and wetlands. For comparison, just 15% of the total *non*-wetland area of Island County is on top of highly susceptible aquifers. Thus, although such aquifers are more likely to be overlaid by uplands rather than wetlands, the *proportion* of wetlands that are situated on top of such aquifers is greater than the proportion of uplands that are. See Appendix D7 for additional data summaries.

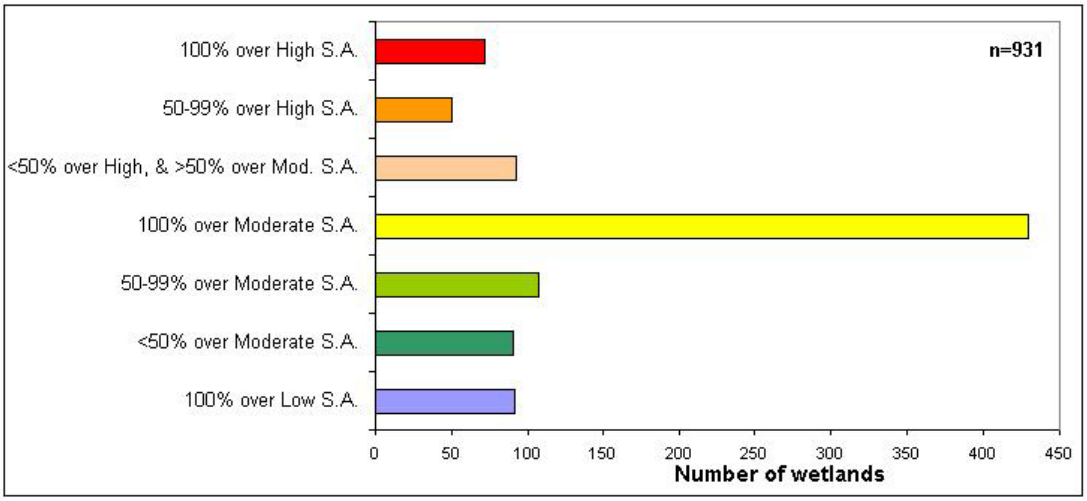


Figure 14. Association of wetlands with Highly Susceptible Aquifers in Island County

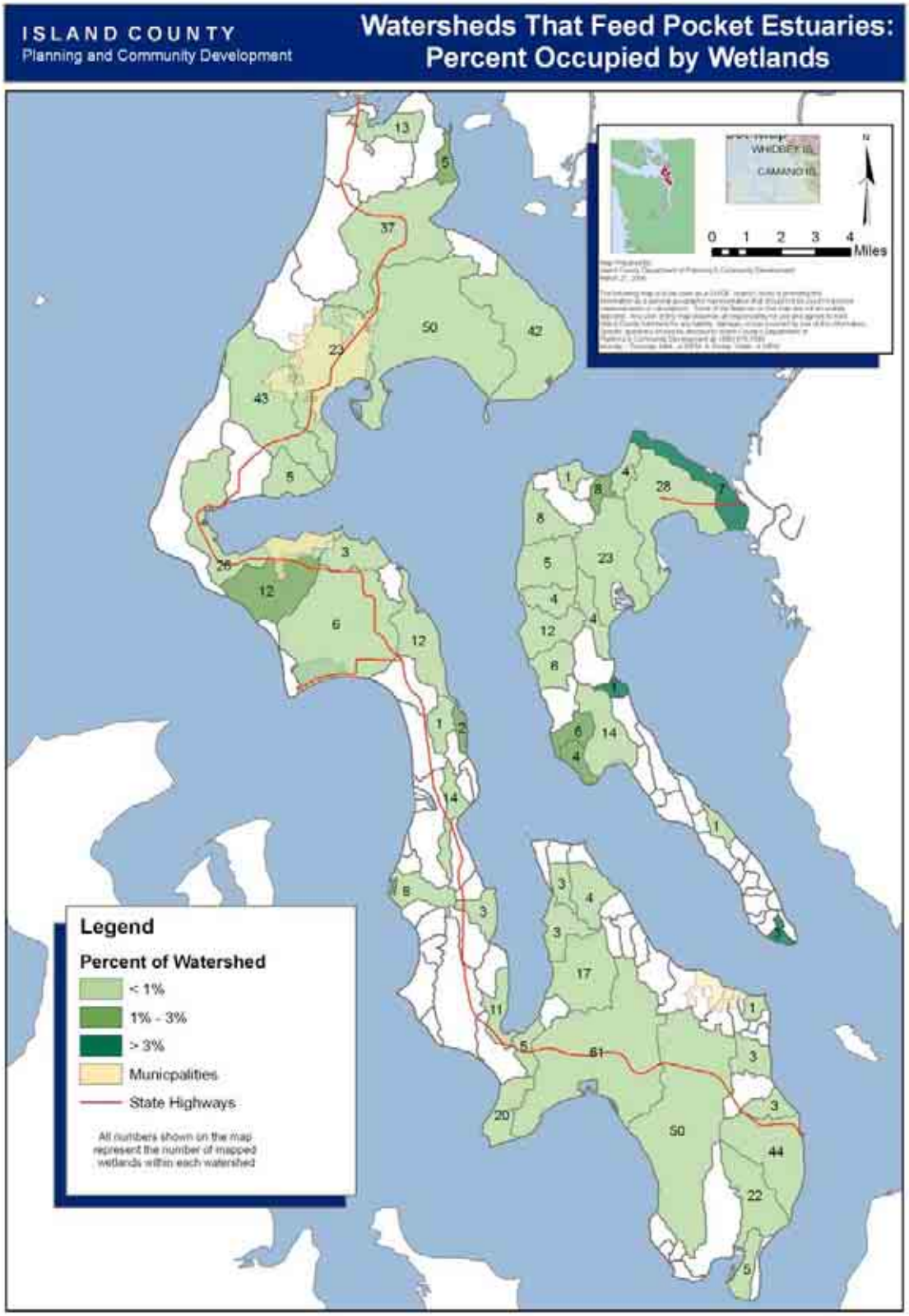


Figure 15. Wetlands as a percent of watershed acreage in Island County watersheds that flow into pocket estuaries

4.0 Changes in Island County Wetlands, Their Resources, and Surroundings

As a backdrop for understanding changes that have occurred to the County's wetlands more recently, this chapter first describes conditions in the Island County environment prior to 1984. That was a milestone year, because it was the year the citizens of Island County adopted the County's first ordinance to protect wetlands. However, there are no quantitative data that describe the area, type, functions, uses, and/or health of wetlands of Island County prior to 1984. Thus, in order to analyze fully the effect of the 1984 ordinance, we had to rely heavily on anecdotal historical accounts (section 4.1 below). Subsequent sections use more quantitative data to examine possible compliance with County wetland regulations in the periods 1985-1998 (section 4.2), and 1998 to 2005 (section 4.3). The year 1998 was chosen because it was when the County last updated its Critical Areas Ordinance and because comprehensive aerial photographs useful for trends assessment are available from that year.

4.1 Wetland Conditions in Island County: Presettlement to 1984

Before non-indigenous settlers began arriving in numbers in the mid-1800's, Island County may possibly have had 22,574 acres of wetlands (17% of the County)[19], compared to 13,428 acres (10%) currently. Thus, since presettlement times about 41% of the County's original wetland acreage has been converted to other uses or, less likely, changed naturally into upland as a result of sedimentation or prolonged dry periods. Statewide, the wetland loss rate from presettlement times to 1992 is estimated as 25% (Anderson and Magleby 1997) or perhaps 31% (NOAA 2006), but was surely much higher in urban areas and Western Washington generally. For the lower 48 states, the wetland loss rate during that period is estimated as 44%.

Although data are lacking, information from historical accounts suggests that the overwhelming majority of wetland conversions occurred in the late 1800's and early-to-mid 1900's, as settlers

[19] This is the sum of hydric soils plus non-hydrics that currently have wetlands. Thus, in the absence of wetland inventories from the 1800s, the 29 soils designated by NRCS as "hydric" are used as a surrogate for the original wetlands, and to these is added the current acreage of wetlands existing on non-hydric soils. Among wetland scientists, this is standard practice for estimating historic wetland extent. The current known extent of wetlands, as represented by our composite wetland map, was overlaid on the NRCS soil map. Hydric soils currently with or without wetlands were highlighted. Although the NRCS data were based on soil surveys done in the 1950's, the identifying characteristics of most soils do not change substantially over time, even with cultivation, so the County soil survey can be assumed to be generally representative of the presettlement distribution of most soil types.

[19] If a substantial acreage of wetlands was not mapped as wetlands by the County or by the National Wetlands Inventory (which relied entirely on interpretation of aerial photographs from the 1970's), then these loss rates are overestimated. Overestimation may also occur, although to a lesser degree, as a result of some non-hydric soils becoming wetlands (i.e., their soils taking on hydric characteristics) as a result of drainage blockage and/or from rising water tables following the removal of forest cover, after the 1950's County soil survey was completed. On the other hand, underestimation may occur because many soil types that are not classified and mapped as "hydric" often contain inclusions of hydric soil, thus making the original total for hydric soil acreage somewhat greater. If 6643 acres of those 8 "partially-hydric" soil types which occur in relatively flat terrain are added to the original total of hydric soils, the presettlement extent of wetlands might have been as much as the 23,674 acre figure.

aggressively drained and diked wetlands to create farmland (Bortelson et al. 1980, White 1992, Fischer and Harper 2001). Considering all of Puget Sound, Island County and Skagit County together contain not only the greatest area of coastal lagoons and wetlands per unit shoreline, but also have experienced the greatest proportional loss of these, with only 17-19% of their historic extent now remaining (Collins and Sheikh 2005). In the early 1900's, some of the most productive unfarmed soils existed in the County's tidal marshes, and after farmers had occupied the few productive upland areas, many efforts of varying success were made to partially drain and convert the tidal marshes to farmland. By 1937, conversions of formerly-tidal wetlands totaled 1,232 acres in the Useless Bay area, 530 acres in the Dugualla area, and 300 acres in Maxwelton, and 2,576 acres in the developed areas of Oak Harbor, Crescent Harbor, and Clover Valley (White 1992). In addition, at least 3,456 acres of wetland were ditched. The last major diking projects occurred in the 1930's at Crockett's Lake on Whidbey Island and at Davis Slough on north Camano Island. Figure 16 shows the total wetland area present in the early 1800's, with losses reducing the total area of the pie.

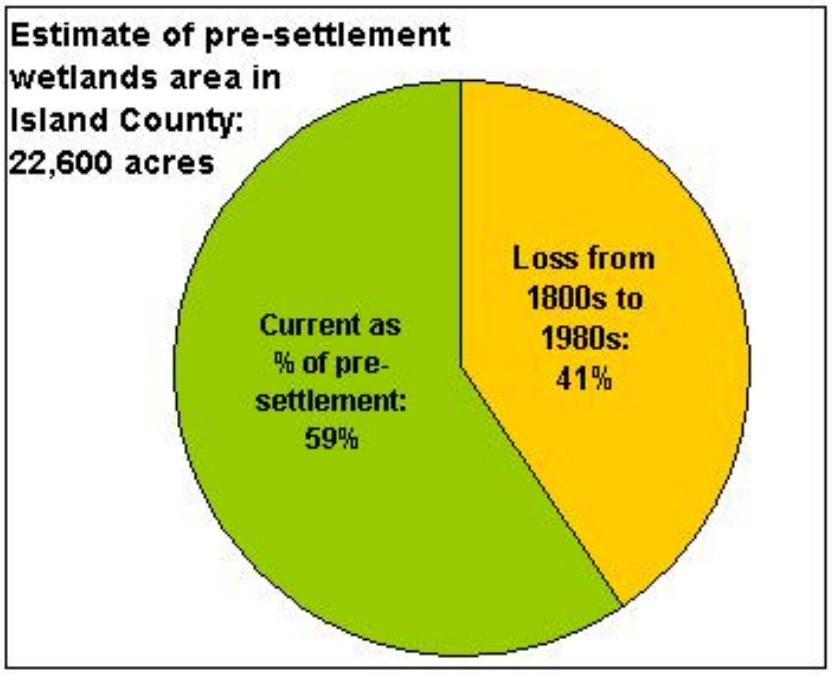


Figure 16. Loss of Island County wetlands from early 1800's to present

Wetland loss rates appear to differ by soil type. About 80% of the soils mapped as peat or muck in the 1950's still have wetlands on them, whereas 36% of the hydric soils on flat slopes that were mapped as having a loam or clay component still have wetlands on them, and only 15% of the hydric soils mapped as having a sand or gravel component still have wetlands on them. Thus, apparent wetland losses have been greater on the sandier hydric soils, many of which are associated with the Developed Low Density land cover category (Table 8). See Figure 18 for areas where wetlands may have been converted to different land cover categories.

Wetland losses over the long term reflect not only a reduced *number* of wetlands remaining in Island County, but also a shrinkage of the *area* of wetlands and loss of their hydrologic *connectivity* to other wetlands, streams, and estuaries. About half (48-53%) of the County's mapped wetlands are adjoined by hydric soils that currently do not contain wetlands. This suggests the extent to which formerly-

larger wetlands have been drained, and/or shows the imprecision of delineations in maps prepared by NWI (wetlands) and NRCS (soils). Maps show that between 24.9 and 149.5 miles of stream that formerly might have been bordered by wetlands appear to no longer contain a wetland border[20] (Table 9). This represents between 11 and 67% of the County's total stream length. The conversion of wetland and riparian areas associated with the streams, whenever it occurred, would be expected to adversely impact the health of the County's estuaries. Knowledge of species ecological requirements suggests that the long term loss of the County's wetlands also could be partially to blame for reported declines in several plant, fish, amphibian, reptile, and bird species (page 41). However, quantitative species data (of sufficient rigor and comparability among multiple time periods) as well as reliable data on former distribution and type of wetlands are insufficient to demonstrate this conclusively.

Table 8. 1nferred historical conversions of possible wetlands in Island County

Originally Was Possibly*:		Currently Existing as:				
		Wetlands (acres)	Developed High Density (acres)	Developed Low Density (acres)	Agriculture (acres)	Other Natural (acres)
Wetland: Peat/ Muck	Flat	1,769.73	74.29	200.28	121.44	52.96
Wetland: Loam/Clay	Flat	3,156.60	604.27	2,692.16	2,030.28	403.33
Wetland: Loam/Clay	Slope	171.11	71.41	97.79	8.83	20.60
Wetland: Sand/Gravel	Flat	392.56	394.63	1,359.48	239.67	167.25
	TOTAL=	5,490.00	1,144.60	4,349.71	2,400.22	644.14

* Presence of wetland was assumed because of current presence of a designated hydric soil. Hydric soils were assigned to a texture category as follows (abbreviations are the NRCS soil map symbols):
Peat= Ga, Mb, Mc, Ra, Rb, Ta, Tb, Tc. Muck= Ca, Fa, Sc, Sd. Sand= Ha Clay= Lc, Pb. Loam: all other hydrics.
"Flat" indicates a soil map unit that generally has a slope of less than 5%.
"Developed High Density" is areas zoned as Municipal or with 1998 Land Cover grid code of 1.
"Developed Low Density" is areas zoned as Municipal or with 1998 Land Cover grid code of 2.
"Agriculture" is areas zoned as Commercial Ag, Rural Ag, or confirmed to have agriculture during field surveys of the Rural zoning category
"Other Natural" is areas with 1998 Land Cover grid codes 5-7, 9-17, 19-21, 27-32

Peat bogs and forested wetlands were probably much more common in presettlement times than today, due to the absence of logging and other disturbances. Nonetheless, indigenous peoples regularly burned small portions of the islands, partly to increase habitat for wildlife species they hunted (White 1992). This was especially the case in northern parts of Whidbey Island, where prairie habitats were sustained partly by centuries of regular burning. Fires before and especially during the years following the arrival of settlers favored an increase in Douglas fir at the expense of western hemlock, Sitka spruce, and western red cedar (White 1992). Native peoples propagated and managed at least one specific wetland plant—nettles (*Urtica dioica*) – for a variety of uses.

[20] It is possible that some of these stream channels might not have existed historically. Interpretive caution is advised because of the uncertainty of using all hydric soils as surrogates for historical wetlands. This, plus the lack of a field-verified or consensus map of the County's streams, is why the ranges given are so broad.

Table 9. Estimates of possible historical losses (in feet) of riparian wetlands in Island County, by soil type and riparian type

Note: These losses occurred prior to interpretation of 1970's airphotos used to draft the wetland maps. The big differences in the sums at the end of this table are due to uncertainty about which areas (all hydric soils, or all hydric soils plus soils with hydric inclusions) to use to represent presettlement wetland extent. Nonetheless this information could be used as a general guide to target wetland restoration opportunities (e.g., soil types) that might provide the most benefit to streams.

Soil Type (musym)	Stream Riparian (ft)	Ditch Riparian (ft)	Side Channel Riparian (ft)	Total (ft)
Aa	1214	0	0	1214
Ab	7038	0	0	7038
Ae	52636	49	0	52686
Af	35957	0	0	35957
Ba	12340	856	0	13195
Bb	1725	222	0	1947
Bc	5856	2278	0	8134
Ca	4145	0	0	4145
Ce	5729	0	0	5729
Ck	2758	0	0	2758
Cm	3616	0	0	3616
Cn	7962	0	0	7962
Co	1748	0	0	1748
Ea	3022	273	0	3296
Fa	93	0	0	93
Ga	60	0	0	60
Ha	2125	422	0	2547
Hf	36186	0	0	36186
Kc	74057	0	0	74057
Kd	76999	38	0	77037
La	2098	2698	0	4797
Lb	11028	8858	0	19886
Lc	539	5286	0	5825
Mb	2453	0	0	2453
Mc	0	327	0	327
Na	15732	0	0	15732
Nb	2936	0	0	2936
Nc	7460	0	0	7460
Pb	5176	2546	0	7722
Ra	5829	0	0	5829
Rb	3340	0	0	3340
Rc	24117	659	73.65941	24849
Sc	2372	0	0	2372
Sd	689	0	0	689
Sg	4503	0	0	4503
Sh	5404	0	0	5404
Sk	481	0	0	481
Ta	264	56	0	320
Tb	2779	0	199.20317	2978
Tc	5	0	0	5
Td	2170	313	0	2483
Te	2517	0	95.24799	2613
Tf	1778	0	0	1778
Wa	780	0	0	780
Wb	251771	1082	452.33859	253305

Soil Type (musym)	Stream Riparian (ft)	Ditch Riparian (ft)	Side Channel Riparian (ft)	Total (ft)
Wc	71144	0	0	71144
LOW Estimate (a)	107294	23863	199	**131,357**
HIGH Estimate (b)	762627	25965	820	**789,412**

(a) Based on overlay of currently non-wetland areas with map of soils categorized as "hydric" by NRCS, and subsequent GIS overlay with the WDNR map showing the present locations of streams
(b) Based on overlay of currently non-wetland areas with map of NRCS soils categorized as "hydric" or potentially with hydric inclusions, and subsequent GIS overlay with the WDNR map showing the present locations of streams

As settlers arrived, farming focused first on the County's rich but very limited prairies, such as Ebey's Prairie. Plowing of the virgin prairie (especially soils of the Townsend sandy loam series) broke down the structure of its soils, reducing their water-holding capacity (White 1992) and perhaps shortening the duration of annual flooding in some seasonal wetlands. In the 1850's, settlers introduced cattle and hogs whose grazing and rooting activities, combined with many non-native plants introduced as forage, inevitably altered the local flora, including that of seasonal wetlands. Overgrazed areas typically supported a profusion of the non-native thistle (*Cirsium arvense*) and velvet-grass (*Holcus lanatus*). About the same time, wolves and elk were exterminated from the islands and numbers of beaver were greatly diminished (White 1992).

As more settlers arrived, many attempted to bring forested areas into cultivation, although the slow and tedious process of burning and then removing the stumps limited these "stump farm" conversions. The alteration of forests, whether for farming or commercial logging, presumably increased the relative extent of open-canopied wetlands, and some previously non-wetland areas likely became wetlands as local water tables rose temporarily and runoff increased following the extensive removal of trees, and as drainage pathways became blocked with debris. Many soils became relatively unproductive following the removal of forest canopy as increased soil moisture leached out the accumulated nutrients (White 1992). Fires became more frequent as commercial logging expanded in the early 1900's. The last areas of virgin forest were eventually logged in the Deception Point area. Most of the island's bogs (acidic wetlands characterized by a particular type of moss), were excavated for commercial harvest of their peat and/or were drastically changed by repeated fires and attempts at drainage.

Although there are no data to document this in Island County specifically, soil erosion and the delivery of sediment to tidal wetlands also might have increased as a result of land clearing, farming, and logging. The sediments probably degraded stream and freshwater wetland habitats while allowing tidal marshes and flats to expand slightly outward wherever shoreline slope was gradual.

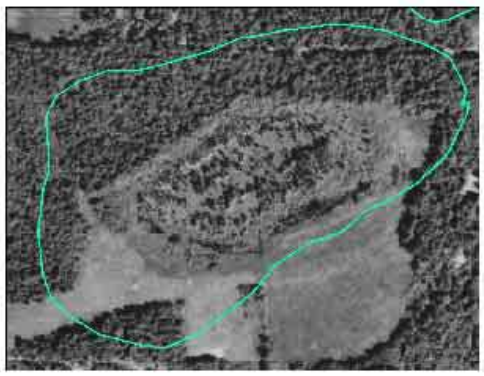
By the 1940's, military facilities and supporting commercial developments had become well established on north and central Whidbey Island. Increasing numbers of Island County residents also were commuting to the mainland and/or were vacationing seasonally on the islands. This trend resulted in rapid expansion of roads and other paved areas, which in turn spawned additional growth and impacts to critical areas. Many ponds also were constructed at about this time, for aesthetic reasons or as water sources for livestock. Many if not most were created by excavation of wetlands that previously had contained surface water only seasonally. New residential developments were often accompanied by introduction of non-native plants, landscaping of previously natural landscapes, and changes in the quality, quantity, and timing of runoff and sediment that reaches wetlands.

As residential growth expanded, commercial logging, peat mining, and farming gradually waned, although mostly for unrelated economic reasons. In the 18-year period between 1966 and 1984, 7,342

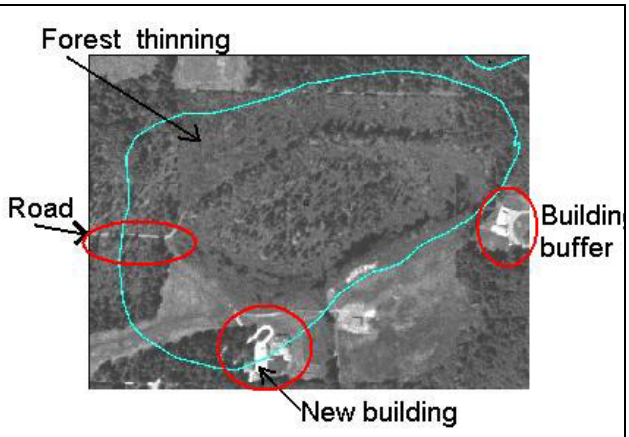
new lots (407/yr) were created (mean density 0.8 acre) and 5,889 acres were platted. For comparison, in the 12-year period between 1985 and 1997 in the County's Rural Areas of Intensive Development (RAIDS), 1,983 new lots were created (165/yr, mean density 2.39 acres) and 4,740 were platted. And in the 7-year period between 1998 and 2005, 521 new lots were created (74/yr, mean density 3.63 acres) and 1,893 were platted. The reduction in the number of lots per year cannot be attributed solely to the Critical Areas Ordinance. However, chapter 17.02 ICC of the Critical Areas Ordinance does limit land-division and lot creation in areas adjacent to wetlands and other critical areas.

4.2 Changes Apparent Between 1985 and 1998

Low-resolution (15-inch) aerial photographs for the years 1985 and 1998 of essentially all Island County wetlands were examined to identify development occurring between those years. Results are shown in Table 10 and Figure 19. Essentially, if alterations were not noticed in the 1985 image but were shown in the 1998 image, it was assumed that the alteration happened during this time period.



Aerial photo, 1985. Approximate wetland boundary (not field-verified) is circled



Same area, 1998

Figure 17. Changes in a wetland visible in aerial photographs from two time periods

The ecological health and functioning of wetlands is potentially influenced by alteration of lands surrounding them. Between 1985 and 1998, 37% of the land within 300 ft of wetlands had apparent additions of roads or buildings, or clearing of vegetation (note that those in the 100-300 ft portion were legal). Even after accounting for the smaller area of the zones nearest the wetlands, the numbers of apparent alterations were fewer closer to wetlands (e.g., within 50 feet) than at greater distances, suggesting an overall compliance with County buffer regulations. The majority of all new types of alterations in wetlands occurred closer to the wetland-upland edge than to the center of the wetlands (Table 10 and Table 11). This contrasts to alterations that have occurred throughout time, where substantially more vegetation was cleared throughout the wetland and relatively few roads and buildings were placed in the center of the wetlands (Appendix C5 and C6).

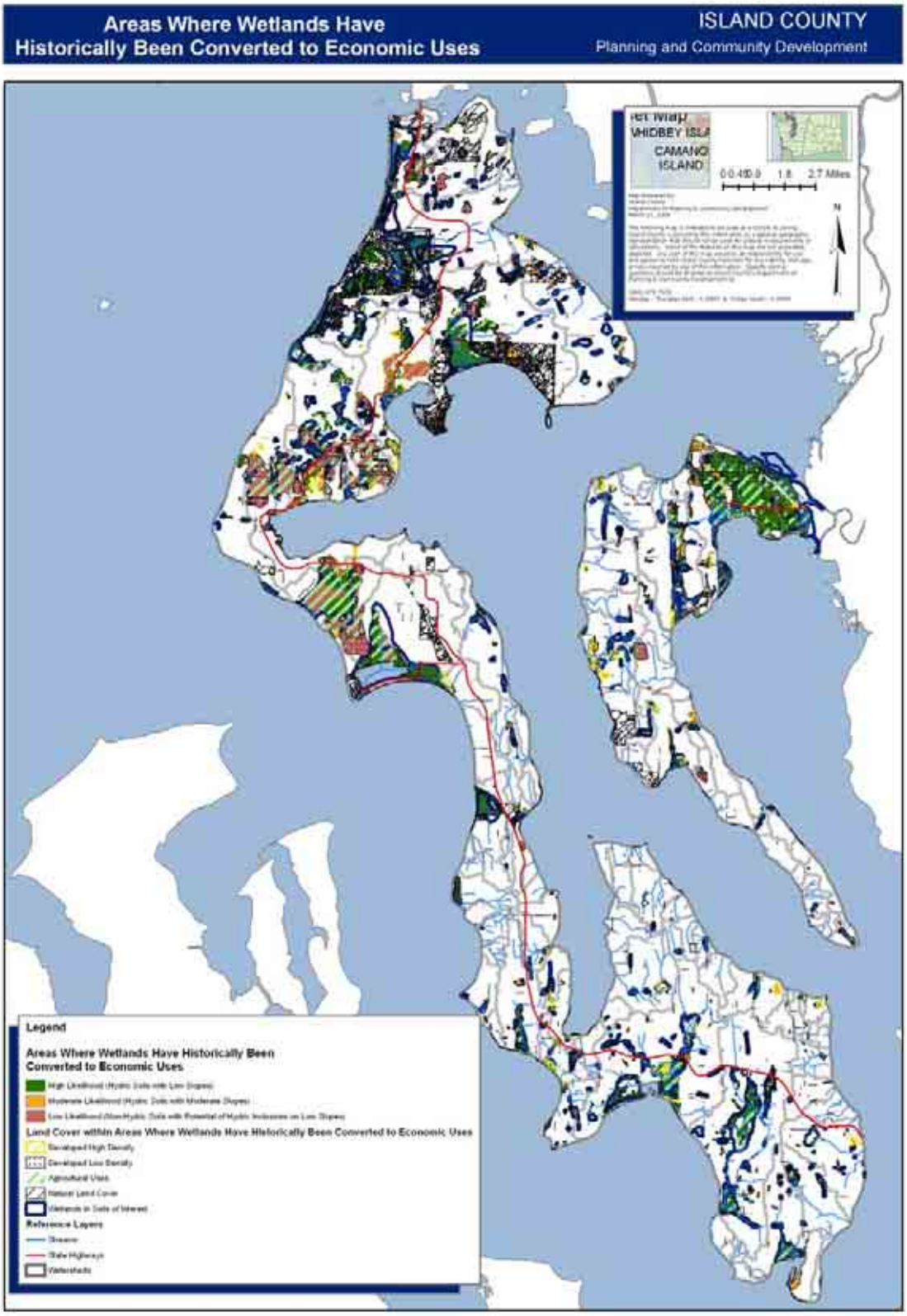


Figure 18. Areas where wetlands have historically been converted to economic uses

Table 10. Summary of alterations, 1985-1998, in Island County wetlands and their upland surroundings within 100 feet as interpreted from comparisons of aerial photographs

Note: Percentages are given as the percent of the number of wetlands, rather than percent of wetland area, because due to limitations of the imagery these changes could only be identified, not accurately measured. In most cases the alterations appeared to occupy less than 5% of the wetland and less than 5% of the area surrounding it within 100 ft. These numbers describe the number and percent of wetlands where no ICPCD (Whidbey Office only) permit file could be found indicating that an alteration noted in the aerial photographs during this was approved. The large percentages of clearing and roads that lack documentation is likely due to the WDNR not maintaining an electronic database of timber harvest permit data prior to about 1996. Lack of documentation could indicate illegal activity, spatial imprecision in the mapped wetland boundary and consequently the 100-ft buffer line, field determination by ICPCD that the mapped area was not a wetland or that the activity was not subject to regulation at a particular site, wetland on municipal or federal land not subject to County jurisdiction, imprecision in correlating permit location with activity observed in airphotos, or incomplete record-keeping.

Location	Detectable alteration, 1985-1997	# of wetlands where detected	% of wetlands	# of detected changes with no file documentation*	% of detected changes with no file documentation*
In wetland	addition of buildings	33	3.46%	1	3%
	addition of roads	42	4.40%	4	10%
	clearing of vegetation	45	4.72%	4	10%
	any of the above	106	**11.06%**		
Within ~100 ft upgradient from the wetland-upland boundary	addition of buildings	75	7.86%	3	4%
	addition of roads	75	7.86%	38	51%
	clearing of vegetation	144	15.09%	75	52%
	any of the above	223	**23.79%**		
Either in wetland or within ~100 ft in an upgradient direction	addition of buildings	103	10.80%		
	addition of roads	96	10.06%		
	clearing of vegetation	174	18.24%		
	any of the above	263	**27.57%**		

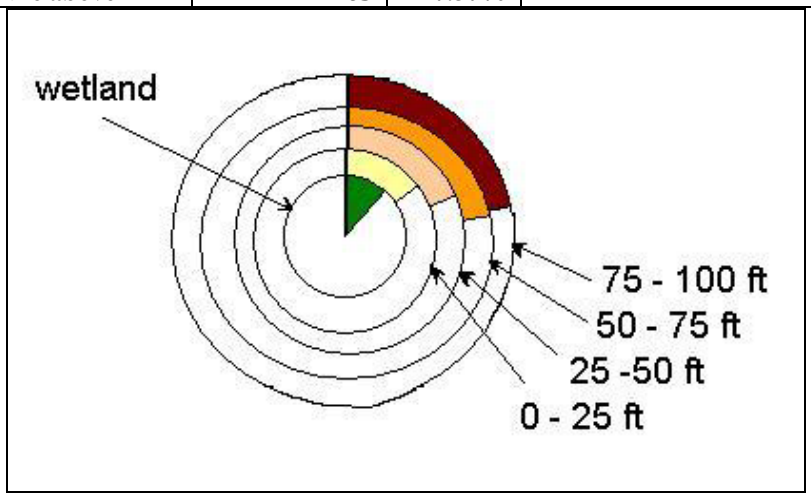


Figure 19. Summary of changes apparent in Island County wetlands and their surroundings as based on comparison of aerial photographs from 1985 and 1998

Graph represents the percent of the wetlands and each surrounding zone where some alteration was noted. Alterations are least within the wetlands (10% with some alteration noted) and greatest farthest from the wetlands (22% of surrounding zones 75-100 feet from the wetland had alterations). However, the outer zones encompass more area so by probability alone are likely to have more alterations, although individually those alterations do not necessarily impact more area. Specifically, among all Island County wetlands the average acreage in each zone is as follows: 0-25 ft (1.47 ac), 25-50 ft (1.55 ac), 50-75 ft (1.62 ac), 75-100 ft (1.70 ft), 100-150 ft (3.64 ac), 150-200 ft (3.98 ac), 200-300 ft (8.98 ac).

Table 11. Location of new alterations to wetlands (n= 942), from 1984 to 1998

	Center	Edge	Throughout
Clearing	3	33	11
Road	6	32	4
Buildings	5	25	3

Tables in Appendix D7 document the wetland sizes, zoning classifications, and other circumstances in which most of the alterations between 1985 and 1998 occurred in the wetlands and their surroundings.

It is important to understand that at the same time some wetlands were being altered, others continued to recover naturally from prior alterations. Interpretation of the 1985 and 1998 airphotos showed several types of recovery within wetlands (Table 12).

In summary, between 1985 and 1998, about **11% of the wetlands** were partially altered by construction of at least one building, or by a section of road or driveway, or clearing of woody vegetation. Portions of the 100-ft upland area surrounding the wetlands were altered in about 24% of the wetlands during that period. In contrast, *recovery* during that period from earlier alterations was apparent in portions of **12% of the wetlands** and in portions of 13% of the 100-ft upland areas surrounding the wetlands. "Recovery" within the wetland or its 100-ft surrounding area consisted of the return of a portion of the forested or shrub canopy, filling in of bare areas by vegetation, overgrowth or removal of buildings or roads, and/or removal or creation of ponds (the last of these debatably being considered "recovery"). An unknown but probably small portion of the observed recovery was the result of County requirements for restoration of wetlands and buffer areas that had been illegally altered by their owner. Studies of mitigation sites in Washington State (Johnson et al. 2000, 2002) and elsewhere have demonstrated that restoring wetlands is preferable to enhancing them, although both strategies are allowed under specific guidelines by federal and state agencies as compensation for wetland impacts. Scientists typically define restoration as including much more than replanting vegetation. If a wetland's water regime (e.g., flow pattern, water table depth) has been altered, restoration may involve restoring that as well. Island County requires annual monitoring for up to three years of restoration in wetlands that have been the subject of CAO enforcement actions, and requirements are specified in ICC 17.02.250.h.2. The process of entering this information into a comprehensive database has begun only recently, with data being kept for 81 restorations (not all involving wetlands). Monitoring was required for at least 34 of these.

Table 12. Apparent recovery by 1998 of wetlands and surrounding uplands within 100 feet, from alterations that occurred prior to 1985, as interpreted from aerial photographs (n= 958)

Note: Percentages are given as the percent of the number of wetlands, rather than percent of area, because due to limitations of the imagery these changes could only be identified, not accurately measured.

	Recovery within wetland (% of all wetlands)	Recovery within 100 ft (% of all wetlands)	Mostly near center of wetland (# of wetlands)	Mostly near edge (# of wetlands)	Scattered throughout (# of wetlands)
Vegetation regrowth (mainly increased canopy cover)	6.37%	5.22%	9	23	29
Vegetation regrowth (mainly in bare or open areas)	3.13%	4.80%	0	21	9
Road removal	0.84%	2.30%	2	5	1
Road overgrowth (mainly by canopy)	1.15%	2.92%	2	5	4
Pond removal	0.21%	0	2	0	0
Building removal	0.31%	0	0	3	0
any of the above types	10.86%	13.26%			

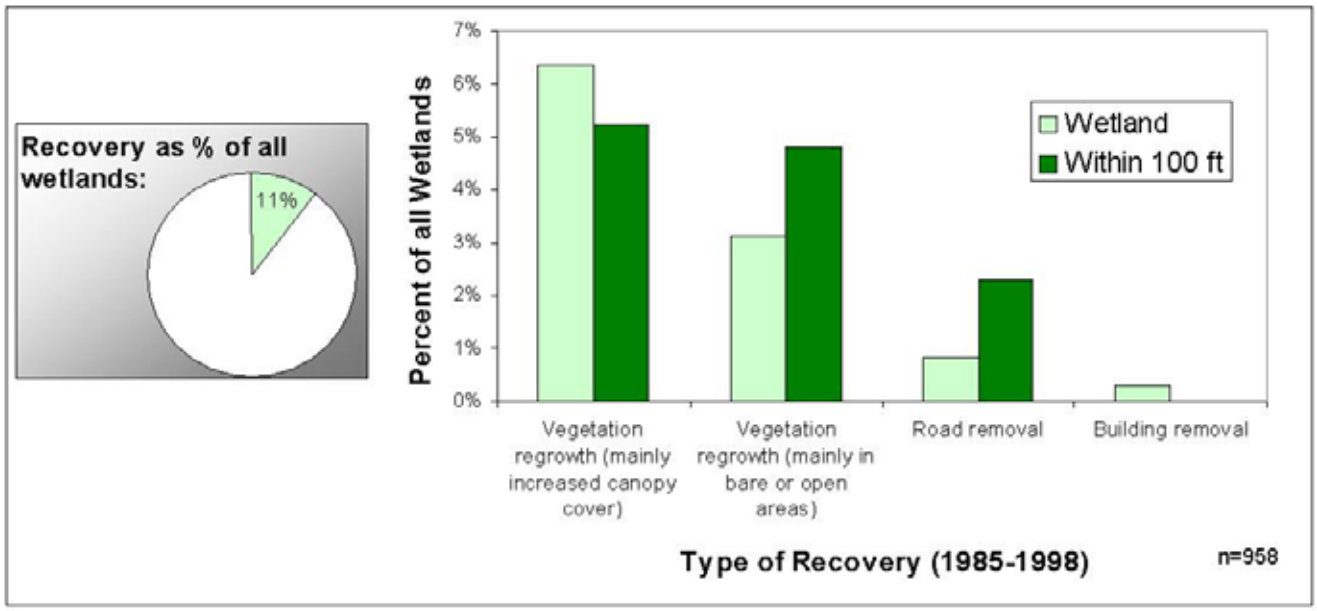


Figure 20. Recovery of wetlands and their surrounding areas up to 100 feet: 1985 – 1998.

4.3 Changes Apparent Between 1998 and 2005

To detect changes during this period, we interpreted aerial imagery for all of the County's 958 wetlands as well as their surrounding areas using the SPOT satellite imagery from 2005 in conjunction with 1998 aerial photographs (see Appendix C6 for procedures). Results are shown in Table 13.

Table 13. Extent of alterations within Island County wetlands and their buffers, 1998-2005, as interpreted from comparisons of 1998 aerial photograph with 2005 SPOT imagery

Note: Percentages are given as the percent of the number of wetlands, rather than percent of wetland area, because due to limitations of the imagery these changes could only be identified, not accurately measured. In most cases the alterations appeared to occupy less than 5% of the wetland and less than 5% of the area surrounding it within 100 ft. These numbers describe the number and percent of wetlands where no ICPCD (Whidbey Office only) or DNR Timber Harvest permit file could be found indicating that an alteration noted in the aerial photographs during this was approved. Lack of documentation could indicate illegal activity, spatial imprecision in the mapped wetland boundary and consequently the 100-ft buffer line, field determination by ICPCD that the mapped area was not a wetland or that the activity was not subject to regulation at a particular site, wetland on municipal or federal land not subject to County jurisdiction, imprecision in correlating permit location with activity observed in airphotos, or incomplete record-keeping.

Location	Detectable Activity, 1998-2005	# of wetlands	% of wetlands	# of detected changes with no file documentation*	% of detected changes with no file documentation*
In wetland	addition of buildings	59	6.16%	12	20%
	addition of roads	4	0.41%	0	0
	clearing of vegetation	19	1.98%	4	21%
	any of the above	**77**	**8.04%**		
Within ~100 ft upgradient from the wetland-upland boundary	addition of buildings	65	6.78%	14	22%
	addition of roads	25	2.61%	1	4%
	clearing of vegetation	37	3.86%	3	8%
	any of the above	**78**	**8.14%**		
Either in wetland or within ~100 ft in an upgradient direction	addition of buildings	94	9.81%		
	addition of roads	27	2.82%		
	clearing of vegetation	47	4.91%		
	any of the above	**122**	**12.73%**		

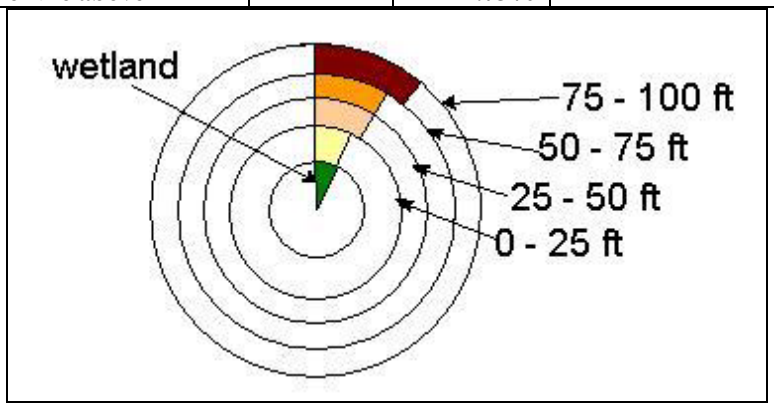


Figure 21. Summary of changes apparent from aerial imagery in Island County wetlands, 1998-2005.

Table 14. Location of new alterations to wetlands (n= 958), from 1998 to 2005

	Center	Edge	Throughout
Clearing	1	15	4
Road	0	1	3
Buildings	4	47	8

If desired, all of the above statistics that describe recent alterations could be broken down further by querying the databases we assembled and subtotaling them by wetland size, geomorphic type, vegetation type, zoning category, likely protection category (A, B, C, etc.), surrounding land use, soil type, connectivity to other wetlands and estuaries, and other variables listed in Appendix B. The number of wetlands recovering during this period from prior alterations was not determined.

4.4 Permit File Records

Since 1985 when the ICPCD first began reviewing proposals for wetland alterations, ICPCD staff have visited at least 421 wetlands (44% of the County's wetlands), in whole or part. These wetlands include a total of over 720 parcels. Staff visited the parcels to determine if they indeed contain wetlands, to generally assess the proposed activity (ranging from construction of a single family residence to installation of a utility line or driveway), and/or to examine violations post facto. The actual number of parcels may be greater than 720 because many visits were not documented, especially in the earlier (pre-1998) years. In many cases documentation was lacking because no regulated wetlands were found, or the proposed activity was judged to have no significant impact on the wetland. Approximately 21-27 of the visited parcels were reported by staff to contain no regulated wetlands.

During the 1985-1997 period immediately following the adoption of the 1984 Wetlands Protection Ordinance, the ICPCD reviewed at least 244 applications for activities potentially affecting 170 wetlands or their buffers. In at least 67 applications the applicant had initially neglected to apply for a permit or was notified of the permit process through enforcement action. These activities did not always constitute a violation because some were for exempt activities. About 149 of the 244 applications were documented as "no action" and consisted of a wetland determination where no project was proposed, or a determination that the wetland and its buffer were well outside the proposed project location. In at least 25 instances approval of wetland or buffer alterations was legally compelled by "Reasonable Use" considerations[21]. Lastly, there were 16 reports of exempt activities such as a utility line installation. Among the remaining applications for which such records were kept, "approval with additional conditions" was granted to 83, monitoring was required for 21, and "approval with no additional conditions" was granted to 30. Overall, the approved activities were buildings (87 permits), vegetation clearing (51), roads or driveways (16), and "enhancements" (5). Overall, the activities that were approved equate to 15.84 acres of wetland disturbance and 9.57 acres of buffer disturbance, potentially affecting 26 wetlands directly and the 100-ft buffers of 22 wetlands during this 13-year period.

[21] Reasonable Use is a legal term dealing with the allowance for exemption from some CAO regulations when the County agrees that prohibition of the proposed use in a critical area would preclude reasonable economic return on the parcel as a whole when used for any purpose.

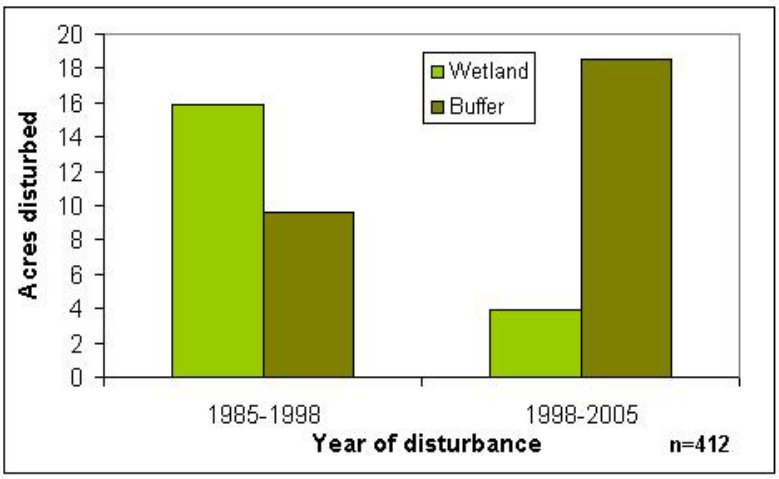


Figure 22. Total area of disturbance to wetlands and their buffers, as recorded in Island County permit files, 1985-2005

For comparison, during the more recent 1998-2005 period following the CAO update of the Wetlands Protection Ordinance, the ICPCD reviewed at least 484 applications for activities potentially affecting 281 wetlands or their buffers. ***The larger numbers are almost entirely a reflection of improved record keeping during this latter period.*** In at least 93 of those instances the applicant had initially neglected to apply for a permit. Again, these activities did not always constitute a violation. In 65 instances approval of wetland or buffer alterations was legally compelled by "Reasonable Use" considerations. About 308 of these cases were documented as "no action" and consisted of a wetland determination where no project was proposed, or a determination that the wetland and its buffer were well outside the proposed project location. Lastly, there were 36 reports of exempt activities such as a utility line installation. Among applications for which such records were kept, "approval with additional conditions" was granted to 117, monitoring was required for 101, and "approval with no additional conditions" was granted to 112. Overall, the approved activities were buildings (235 permits), vegetation clearing (105), roads or driveways (49), and "enhancements" (16). Overall, the activities that were approved equate to 3.92 acres of wetland disturbance and 18.52 acres of buffer disturbance, potentially affecting 41 wetlands and the 100-ft buffers of an additional 66 wetlands during the 6-year period.

As described in Appendix C3, while this project's field crew was assessing the health of 103 Island County wetlands during 2005, they noted various types of alterations within the wetlands and estimated (or asked the landowner) the time period when these occurred (ongoing, recent past, or distant past) and extent (<1% of wetland, 1-10%, 10-50%, >50%). "Ongoing" logging or other vegetation clearing which was not documented in ICPCD permit files or WDNR Timber Harvest files was noted in 2 wetlands, but in both was occurring in less than 1% of the wetland. "Recent past" clearing undocumented in ICPCD or WDNR files was found in 3 wetlands, estimated to cover 10-50% of the wetland in one case and 1-10% in each of the 2 others. No assumptions should be made as to whether these activities were or were not legal or exempt from CAO provisions.

In addition, new developments and vegetation clearing were searched for in nearly all of the 958 wetlands using aerial imagery from 1985, 1998, and 2005 as show in Figure 23 and Figure 24 and described in sections 4.2 and 4.3 and Appendix C6. When wetland or buffer alterations (new buildings, roads, or vegetation clearing) apparently occurring during the 1985-1998 period were compared with documentation in the ICPCD permit files and WDNR Timber Harvest permit files, we

noted file documentation of permits was lacking for 1 new building, 4 roads or driveways, and 4 clearings in wetlands, and for 3 buildings, 38 roads or driveways, and 75 clearings in wetland buffers. From 1998 to 2005, in the mapped wetlands there might have been 4 undocumented cases of clearing, none of road-building, and 12 of building construction. In the 100-ft zone surrounding wetlands, there might have been just 3 undocumented cases of clearing, 1 of roads or driveways, and 14 involving building construction. From the complete time period, 1985-2005, at least 16 of the seemingly undocumented alterations may have files at the Camano Office of the ICPCD but those were not checked. In addition, there are many other possible explanations for the undocumented alterations, so no assumptions should be made about the legality of these changes. Some activities noticed in the aerial photographs may have been exempt from regulations, at least in the particular type of wetland or buffer in which they occurred. Due to lack of a Countywide digital map showing parcel boundaries, permit applications in ICPCD and WDNR files could not be matched exactly with changes noted from aerial photographs. The digital boundaries of wetlands and consequently their buffer zones also have unknown spatial precision, and in some cases a 50-ft rather than the uniformly-presumed 100-ft buffer was legal due to the wetland being a category B wetland. Even when the digital maps show wetlands to be present, field inspection by ICPCD staff or consultants of the particular parcel to which the permit application pertains may have determined that that portion was not a wetland. Finally, in a few cases although application might have been made to the County for some of the activities noticed in the aerial photographs, files might not have been retained.

Of the 720 parcels for which a classification was reported in the permit file, “category A” wetlands number 595 (83%) and “category B” wetlands number 125 (17%). Category C wetlands generally were not noted in the permit file records. Summaries of several individual permits associated with wetlands are provided in Appendix C7.

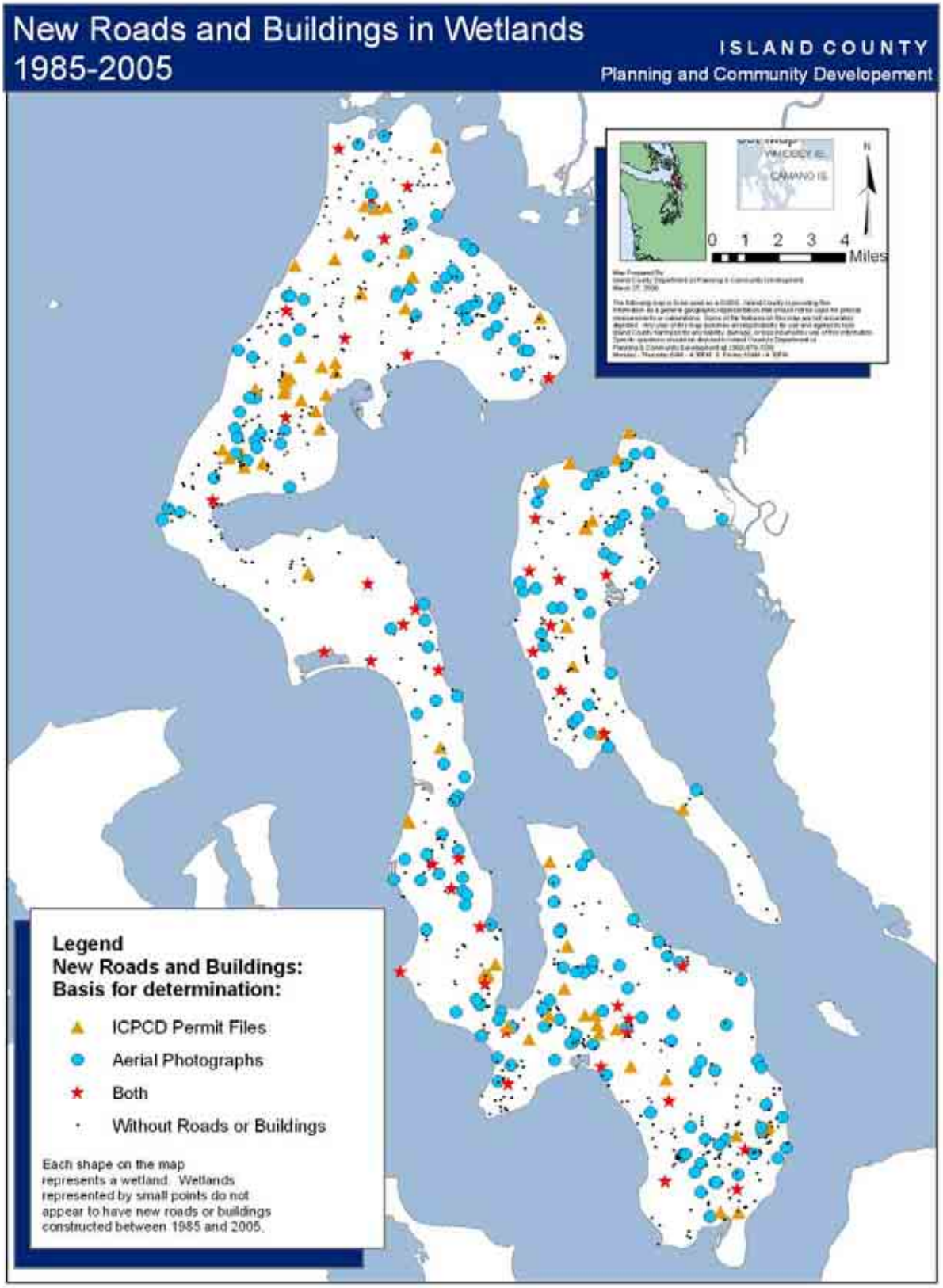


Figure 23. New roads and buildings in wetlands, 1985-2005, detected using Island County permit files and aerial images

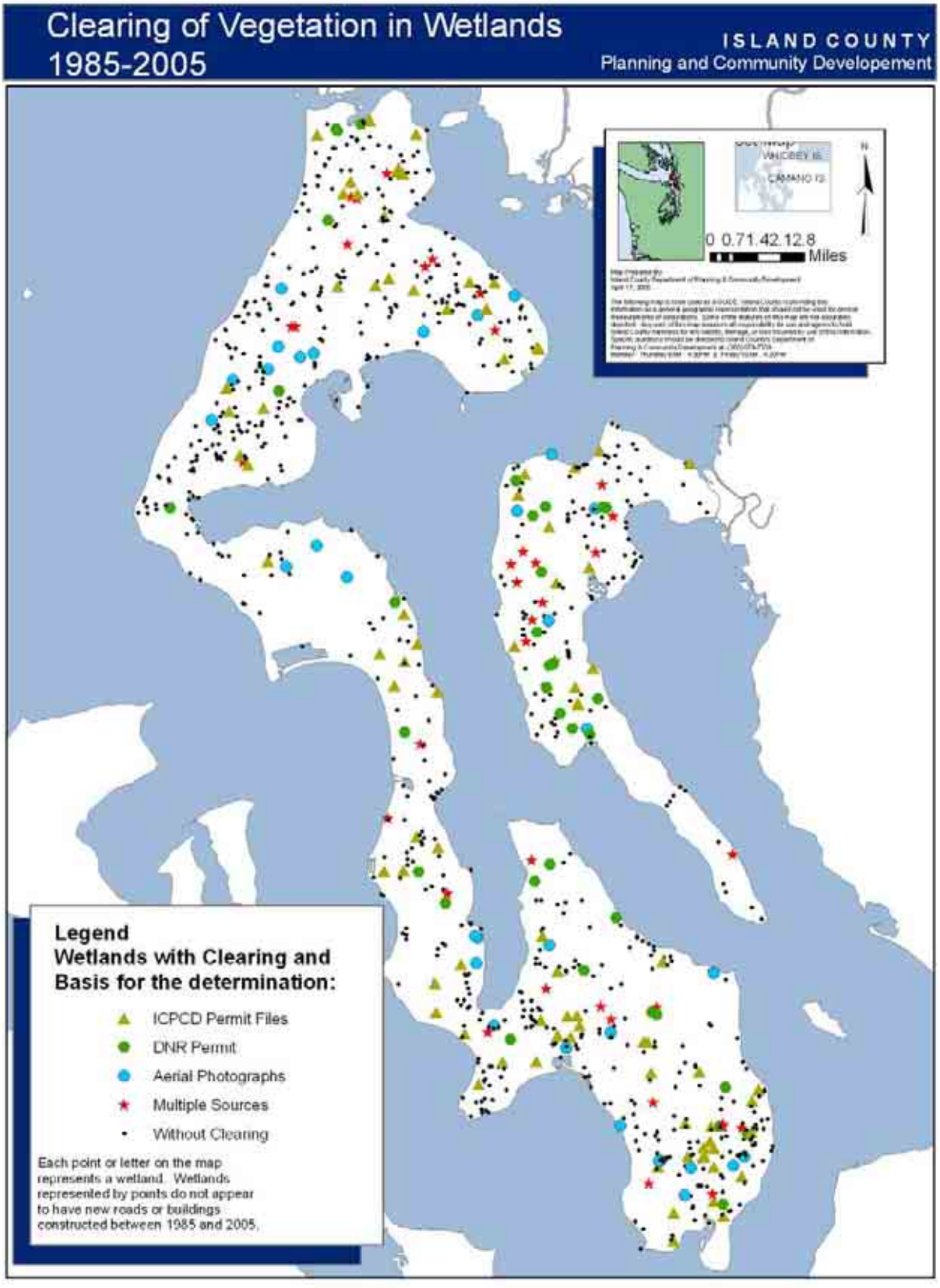


Figure 24. New vegetation clearing in wetlands, 1985-2005, as detected through Island County permit files, DNR timber harvest permit files, and aerial images

4.5 Changes in Populations of Wetland Plants and Animals

As with most jurisdictions, in Island County there is no historical, quantitative baseline against which to compare current fish and wildlife data, such that trends in wetland species could be measured in a scientifically defensible manner. The extirpation of wolves and elk from the County in the mid-1800's is indisputable. Qualitative accounts are sufficient to infer that numbers of salmon and waterfowl have declined sharply over the span of more than a century. Non-native plants have spread into many wetlands at a cost to native species.

However, local data are insufficient to quantify the trend in any plant or animal species before and after adoption of wetland regulations in 1984 and their revision at various subsequent points in time. In most regions, the only multi-year quantitative data available for wildlife are from the Breeding Bird Survey (Table 15) and the Audubon Society Christmas Bird Count. While both have been conducted in recent years in parts of Island County, the data are of insufficient duration, spatial resolution, and consistent quality to reliably assess trends at this point. Also, historical data are virtually non-existent in Island County on the subjects of water quality, sediment contamination, extent of non-native plants, and aquatic habitat structure in wetlands and streams that contribute to wetlands. Thus, impacts of the 1984 wetlands ordinance cannot be determined for any wetland species, either directly or by inference from habitat change data.

However, a *potential* for damages to wetland animals and plants exists from multiple alterations that have occurred in and near Island County wetlands over many decades. For example, the potential for damages to resources on private lands from contaminated groundwater associated with government facilities has been noted by other researchers (Dinicola et al. 2000), as well as *potential* threats to salmon from pesticides used residentially or agriculturally. However, no studies have been done. Although no data are available specifically for Island County, in the Puget Sound - Georgia Basin region generally the pesticides atrazine, prometon, simazine, and tenthiuron were most frequently detected in surface water (Bortleson and Ebbert 2000). In King and Snohomish counties, five commonly sold residential insecticides (carbaryl, clorpyrifos, Diazinon, Lindane, and Malathion) have been found in urban streams at concentrations exceeding maximum limits for the protection of aquatic life (Voss and Embrey 2000). Based on the types and acreages of crops grown, a USEPA report assumed Island County to have the highest acres (3,469) and pounds (7,276) of any Washington County for use of the pesticide malathion, which is relatively persistent and toxic to salmon (Martinez & Leyhe 2004).

Table 15. Wetland-associated bird species that breed in Island County and are declining in the Northern Rainforest region of the Pacific Northwest

Source: Sauer, J. R., J. E. Hines, and J. Fallon. 2005. The North American Breeding Bird Survey, Results and Analysis 1966 - 2004. Version 2005.2. USGS Patuxent Wildlife Research Center, Laurel, MD.

Note: Many wetland species are too uncommon to detect statistically significant trends, so their absence from this table should not necessarily imply their populations are or are not changing. Also, populations of some species may have started to change only recently and thus would not necessarily be identified by the longer (1966-2004) analysis period. The wetland dependence ratings are the author's. The Northern Pacific Rainforest physiographic region, of which Island County is a part, is the smallest geographic region for which reliable trends information is available. Trends are based on roadside surveys and may not reflect trends in habitat that is distant from roads. Larger negative numbers indicate more severe downtrend.

Species		Trend 1966-2004	Association with Wetlands
Decline is Statistically Significant:			
Olive-sided	Flycatcher	-4.2531	Intermediate
N. Rough-winged	Swallow	-3.6656	Intermediate
Barn	Swallow	-3.0425	Intermediate
Song	Sparrow	-1.1117	Intermediate
Great Blue	Heron	-3.6325	Primary
Willow	Flycatcher	-3.3703	Primary
Killdeer		-2.9793	Primary
Yellow	Warbler	-2.4835	Primary
American	Goldfinch	-5.2546	secondary
Rufous	Hummingbird	-4.2475	secondary
Cassin's	Vireo	-4.1662	secondary
Pine	Siskin	-3.7514	secondary
Purple	Finch	-3.5536	secondary
Brown-headed	Cowbird	-3.3448	secondary
Orange-crowned	Warbler	-3.2066	secondary
Band-tailed	Pigeon	-3.0346	secondary
Red	Crossbill	-3.0199	secondary
European	Starling	-2.8047	secondary
Dark-eyed	Junco	-2.6782	secondary
Decline is Not Statistically Significant			
Wilson's	Warbler	-1.9354	Intermediate
Common	Merganser	-1.7838	Intermediate
Swainson's	Thrush	-0.2128	Intermediate
Tree	Swallow	-2.9041	Primary
Spotted	Sandpiper	-2.2506	Primary
Mallard		-1.1907	Primary
Belted	Kingfisher	-0.9246	Primary
Red-winged	Blackbird	-0.4889	Primary
Western	Wood-Pewee	-2.5176	secondary
Golden-crowned	Kinglet	-1.9128	secondary
Rock	Dove	-1.8526	secondary
MacGillivray's	Warbler	-1.5762	secondary
Red-breasted	Sapsucker	-1.5623	secondary
Bewick's	Wren	-1.5198	secondary
Brewer's	Blackbird	-1.2502	secondary
Northern	Flicker	-1.245	secondary

Species		Trend 1966-2004	Association with Wetlands
Yellow-rumped	Warbler	-1.2263	secondary
Steller's	Jay	-1.1421	secondary
Cedar	Waxwing	-0.725	secondary
American	Robin	-0.2527	secondary
White-crowned	Sparrow	-0.2161	secondary

5.0 Current Health of Wetlands and Their Surroundings

5.1 What Are the Indicators of Wetland "Health"?

A major objective of this project has been to estimate the proportion of Island County wetlands that are "healthy." This objective stems from the widely-recognized need to offer a greater level of protection to such wetlands. Yet, scientists and policy makers have long struggled with the question of how to define wetland "health" (and similar terms such as wetland ecological condition, integrity, quality). ***No consensus on a definition of wetland "health"-- let alone an accepted procedure for measuring it comprehensively -- currently exists*** (Young & Sanzone 2002). To some, wetland health means the "naturalness" of a wetland's biological communities, hydrologic regime, and rates of biogeochemical processing. For example, wetlands that support only native species, and especially native species that are intolerant of pollution and other human disturbance, are considered to be the healthiest by this criterion. To other scientists and policy makers, wetland health means the degree to which a wetland performs various functions – such as storing water, retaining sediments, and providing habitat. Still other professionals believe that wetland health should reflect not only the performance of these functions, but also the *value* of the services that are provided to society in specific local settings when the functions are performed. These three perspectives are not synonymous or inevitably correlated (Hruby 1997, 1999, 2001).

Moreover, attempts to define wetland health become confused when the simple presence of activities or features that have the *potential* to alter wetland biological communities, functions, and values are *assumed* without site-specific evidence to have had that effect, and the alteration is assumed to inevitably be "negative" from a human perspective. For example, a garden adjoining a small, sensitive wetland has the potential to introduce pesticides to the wetland and introduce water (e.g., sprinkler runoff) into the wetland during normally-dry summer periods. But without further evidence this cannot be assumed to occur, because many gardeners avoid using pesticides and watering their gardens. If a garden is watered and excess water seeps into the wetland, the effect on wetland functions, values, and health cannot be assumed to necessarily be negative.

Given the lack of consensus regarding how best to define wetland health, in this document we provide data that reflect all three perspectives, as well as data on potentially-altering activities. At this stage we have not attempted to integrate these. A major challenge has always been to find *indicators* of wetland naturalness, functions, and value that are both highly repeatable (among different users) and practical to apply. Indicators that are easiest to recognize include vegetation removal, ditches, fill (from roads, buildings), and berms. Many wetland features that could yield the most information for judging wetland health – such as duration and frequency of flooding, primary sources of water, soil organic content, contamination of sediments, and wildlife productivity and consistency of use – cannot be measured without a considerable monitoring investment in each wetland over long periods of time.

In its guidance for critical areas protection, Washington's CTED (2003) does not define wetland health explicitly, but encourages counties and cities to use a wetland rating system or other systematic criteria to identify higher-quality wetlands. CTED recognizes the Western Washington Rating System (Hruby 2004) as one of several tools that could be used to support this objective. Results of our application of

this system to Island County wetlands are described beginning on page 73. Regardless of which methods are used, CTED suggests that wetland ratings and regulatory responses take into account wetland functions, values, degree of sensitivity to disturbance, and rarity (uniqueness). Island County's existing system for categorizing wetlands does not address functions individually or explicitly, but assumes that wetland size and dominance by native plant species provide enough information to protect the more sensitive or important wetlands. An exception is estuarine wetlands, which automatically receive the County's highest level of protection (Category A).

5.2 Wetland Health: Plants

As noted in section 4.1, often the most rapid and objective (but not comprehensive) approach for estimating the health of wetlands is to visit them and identify their plants. Many plant species can serve as excellent indicators of wetland health (Adamus and Brandt 1990, Adamus et al. 2001, Azous and Horner 2001). See also: http://www.epa.gov/waterscience/criteria/wetlands/
The following table summarizes the level of association of the County's plant species with wetlands. Correlations between particular wetland plant species and various wetland alterations are shown in Appendix D10.

Table 16. Associations of Island County flora with wetlands specifically (number of wetland-associated species, percent of row)

	Strongly require wetlands (OBL)	Require or prefer wetlands (FACW)	Use wetlands or uplands (FAC)	Typically non-wetland	Total
Plants: total	118 (16%)	106 (14%)	70 (10%)	446 (60%)	740
(Plants: ferns)	1 (6%)	4 (22%)	5 (28%)	8 (44%)	18
(Plants: herbs)	82 (16%)	62 (12%)	42 (8%)	329 (64%)	515
(Plants: grasses)	32 (26%)	26 (21%)	11 (9%)	53 (43%)	122
(Plants: woody)	3 (3%)	14 (16%)	12 (14%)	56 (66%)	85

Under the law (ICC17.02.110.C), seven plant species are listed by Island County as "Sensitive, Threatened, or Endangered." Of those, 5 (according to the US Fish and Wildlife Service) can occur normally in wetlands in this area and are:

Scientific Name	Common Name	Degree of Association with Wetlands*
Agoseris elata	Tall agoseris	FAC
Cicuta bulbifera	Bulb-bearing water hemlock	OBL
Fritillaria camschatcensis	Indian rice; black lily	FACW
Morella (Myrica) californica	California wax myrtle	FACW
Puccinellia nutkaensis	Alaska or Pacific alkaligrass	OBL

* FAC= facultative; FACW= facultative wet; OBL= obligate

None of these species were found in the parts of the wetlands visited in 2005, and the ICPCD Planner responsible for wetland permit reviews reports he has not found them either while doing field reviews of permit applications, despite searching and being familiar with their identification.

This study was not intended to comprehensively survey the flora of any wetland visited, nor estimate accurately the percent cover of even the most dominant species present. Confounding the data was the fact that, in order to visit all 103 wetlands, the field season had to cover the period from June to October (Figure 25). Consequently (a) the ability to identify many herbaceous species declined as the season progressed and these species wilted, died, or in some cases were mowed, and (b) some rare species were almost certainly missed.

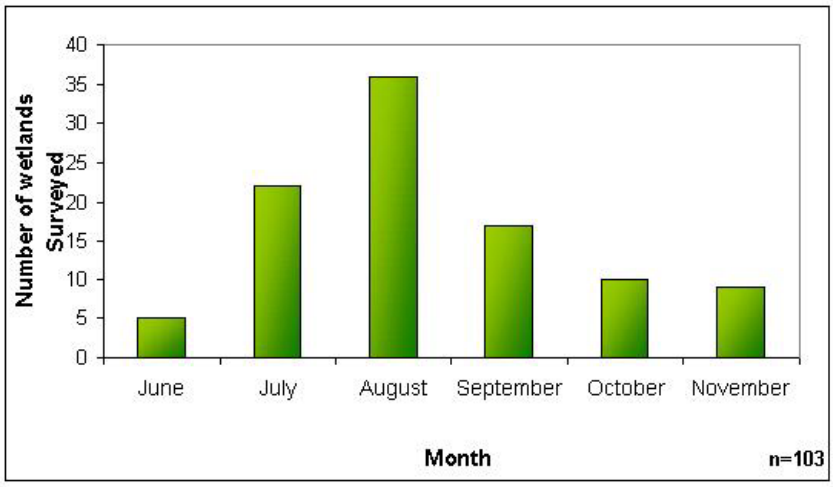


Figure 25. Number of wetlands surveyed by month in 2005 by ICPCD wetlands project

To partly compensate for these limitations, an online search was made of Burke Herbarium records, and a few recent published reports, along with data from the Washington Natural Heritage Program, were searched for noteworthy occurrences. Understandably, critical information on precise location and date of rare species occurrences was almost always lacking from those data sources. Based mainly on those sources, wetland-associated (FAC, FACW or OBL) plant species that have been reported from Island County but which we did not identify in any of the 103 wetlands we visited are listed, along with those found, in Appendix D4. We found 55% of the wetland species known from Island County, and the percentage would be higher if FAC species are excluded as wetland indicators. The degree to which any of the unfound species still occur in Island County wetlands is unknown. The unfound species tended to be slightly more characteristic of wetter wetlands than the species we found, perhaps reflecting their disappearance or dormancy due to prolonged water table drawdowns, or simply our difficulty in surveying underwater and other very wet portions of wetlands.

As noted in section 4.1, often the most rapid and objective (but not comprehensive) approach for estimating the health of wetlands is to visit them and identify their plants. By that approach, "healthy wetlands" are defined as ones dominated by native wetland-associated plants. Scientists consider the healthiest wetlands to be the ones that almost totally lack non-native species (especially the more invasive weedy species)[22]. Abundant non-native species such as reed canarygrass (*Phalaris arundinacea*) typically invade wetlands whose vegetation, water, and/or sedimentation regimes have been disturbed, especially due to human activities (e.g., urban development, agriculture) at a local or

[22] "Invasive" non-native species have been defined as those that produce large numbers of reproductive offspring at considerable distances from parent plants. If those plants spread by seed, a source 300 ft away may take less than 50 years to invade; if they spread by roots or creeping stems, a source 20 ft away may take less than 3 years to spread (Richardson et al. 2000).

watershed scale. Their invasion typically causes the disappearance of many native species (Werner & Zedler 2002). Table 17 summarizes what we found in the 89 wetlands in which species and their spatial dominance was noted. Figure 26 shows the number of wetlands with varying percent compositions of non-native species. Additional statistical summaries are in Appendix D7.

A Native Plant (*Salix sitchensis*)– Native plants were found in all surveyed wetlands, and 80% were dominated by native emergent species.

A Non-Native Plant (*Senecio jacobaea*)– At least one non-native species was found in 91% of the wetlands surveyed. 28% had more than 5

Table 17. Incidence and dominance of non-native and noxious plant species in surveyed Island County wetlands

Note: Wetland planners and scientists generally consider "healthy" wetlands to be ones that, among many other things, have few non-native or noxious plants, measured either as number or proportion of species, or by their status as dominants within at least one of a wetland's vegetation strata.

	# of species per wetland (a)	# of wetlands where found	% of assessed wetlands
Non-native Plants: Number of wetland-associated non-native plant species	0	8 (b)	9%
	1-2	23	26%
	3-4	33	37%
	5-6	18	20%
	7-10	7	8%
	mean= 3.40		
Non-native Plants: Number of wetland-associated non-native plant species that were dominant in one or more strata	0	58 (b)	65%
	1	27	30%
	2-3	4	4%
	mean= 0.40		
Noxious Plants: Number of all noxious non-native species (c)	0	9 (b)	9%
	1-2	26	25%
	3-4	21	21%
	5-6	29	28%
	7-10	22	22%
	11-13	4	4%
	mean=4.36		
Most Noxious Plants: Number of the most noxious non-native species	0	12 (b)	12%
	1-2	32	31%
	3-4	27	26%
	5-6	22	22%
	7-10	9	9%
	mean=3.15		

(a) Note: the number of species often increases more with increasing wetland size than with improving wetland health.

(b) Locations of these high-quality wetlands can be determined by querying the accompanying databases. Database queries also can be used to break down the above statistics by wetland size, geomorphic type, vegetation type, zoning category, likely protection category (A, B, C, etc.), surrounding land use, soil type, connectivity to other wetlands and estuaries, and/or other variables listed in Appendix B.

(c) As listed by state agencies, these species are not necessarily the most invasive. Many are listed due to their toxicity to livestock.

Table 18. Non-native plant variables: comparison with other Western Washington wetland surveys

Note: Wetland planners and scientists generally consider "healthy" wetlands to be ones that, among many other things, have few non-native or noxious plants, measured either as number or proportion of species, or as percent-cover. Data from this study (column 3) pertain only to emergent species; those from the other studies may include some woody species.

	data categories	This Study (n= 102 wetlands)	Johnson et al. (n= 25 wetlands) (a)	Cooke (n= 24 wetlands)	Hruby (unpub.) (n= 54 wetlands) (b)
Non-natives: % overall cover	0	13%	8%	not reported	41%
	1-24%	55%	28%	not reported	33%
	25-49%	13%	36%	not reported	13%
	50-75%	10%	12%	not reported	4%
	>75%	11%	16%	not reported	9%
	mean=	(23% cover)	not reported	not reported	not reported
Non-natives: % of species list	0	6%	0%	not reported	not reported
	1-24%	50%	46%	not reported	not reported
	25-49%	37%	50%	not reported	not reported
	50-75%	7%	0%	not reported	not reported
	>75%	1%	4%	not reported	not reported
	mean=	(23% of sp.)	(27% of sp.)	not reported	not reported
Selected invasive species	reed canary grass	48%	not reported	69%	not reported
	creeping buttercup	43%	not reported	65%	not reported
	soft rush	58%	not reported	58%	not reported

(a) all were mitigation wetlands
(b) Depressional wetlands only, and did not include all non-native species

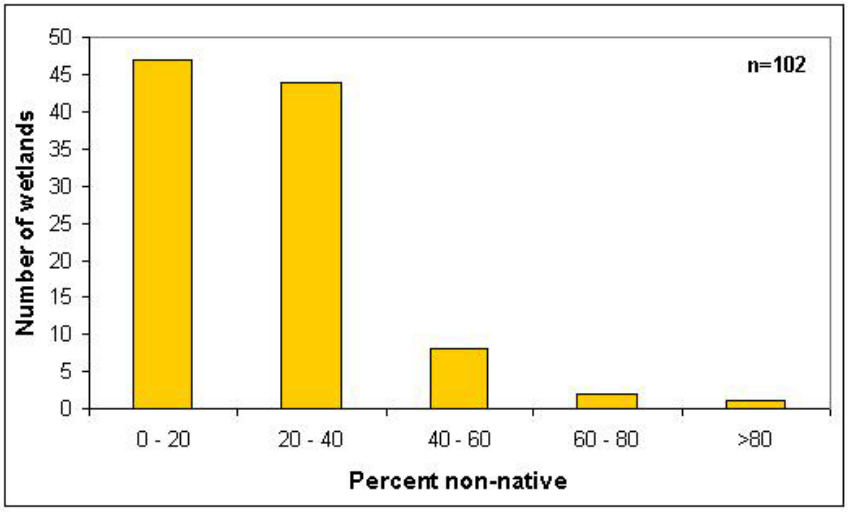


Figure 26. Number of wetlands having various percentages of non-native plant species

Two botanical variables that occasionally are purported to represent wetland health – species richness and moisture coefficient – were not used for that purpose in this project. Some wetland practitioners have assumed that species-rich wetlands are more resistant and resilient to stress and/or generally function at a higher level. However, wetlands recently subjected to certain kinds of disturbances often support, at least temporarily, more kinds of plants than are found in undisturbed wetlands. This is especially true for wetlands of a type that typically is nutrient- and species-poor, such as bogs.

Similarly, the species-specific "moisture coefficients" (Figure 2) that have occasionally been used to define healthy wetlands have several drawbacks. They give greater weight, for example, to species known from technical literature and scientific consensus to be wetland obligates (i.e., characteristically occur only in wetlands) than to upland species that only infrequently occur in wetlands. However, "wetter wetlands" -- as reflected by the moisture coefficients of the component plants -- cannot automatically be assumed to be healthier or to have greater capacity for all functions. Additional information on plants as indicators of wetland health is available in reports from the USEPA (Adamus and Brandt 1990, Adamus et al. 2001).

Little is known about the locations and extent of the apparently diminishing number of bogs that may remain in Island County (Kulzer et al. 2001). Similarly, little is known about the biological characteristics of the apparently least-altered wetlands of each type in Island County. The aerial, digital spatial, and permit file data compiled by this study could be used to identify such wetlands in preparation for field efforts that would characterize, with prior landowner permission, the plants, animals, water quality, and hydrology of those. Such data could serve as a benchmark for long-term monitoring of the effectiveness of the CAO, and as a reference for fine-tuning the CAO and establishing performance standards for the County's wetlands generally.

5.3 Wetland Health: Wildlife

The rapid loss of any habitat type, not just its scarcity, is a concern because local species that have adapted to that type over centuries must suddenly find a way to adapt to the replacement habitat, move away, or perish. Thus, some wildlife species can serve as excellent indicators of wetland health (Adamus and Brandt 1990, Adamus et al. 2001, Azous and Horner 2001). See also: http://www.epa.gov/waterscience/criteria/wetlands/

This study was not intended to include a comprehensive wildlife survey of any wetland visited. We did record observations made incidental to our primary data collection effort. Under the County's Critical Areas Ordinance (ICC17.02.110.C), five species are listed as "Sensitive, Threatened, or Endangered." These are: common loon, trumpeter swan, great blue heron, osprey, and pileated woodpecker. All of these species use some types of wetlands regularly for feeding, but application of the cited section of the ordinance is prompted only if the species actually places a nest in a wetland or its buffer (trumpeter swan is an exception). Habitat preferences of common loon and trumpeter swan are such that they are unlikely to occur in any but the County's largest lakes and estuarine wetlands, and in any case there is no credible evidence of their nesting currently in Island County. The level of association with wetlands of the County's wildlife species is summarized in Table 19.

Table 19. Dependence of Island County fauna on wetlands specifically (number of wetland-associated species, percent of row)

Note: Among bird species, only those that occur in the County regularly (not as vagrants) are included.

	Strongly require wetlands	Require or prefer wetlands	Use wetlands or uplands	Typically non-wetland	Total
Reptiles	0	0	3 (60 %)	2 (40%)	5
Amphibians	7 (88%)	0	1 (12%)	0	8
Birds	22 (17%)	21 (16%)	85 (66%)	0	128
Mammals	3 (7%)	10 (24%)	28 (68%)	0	41

During our visits to 103 wetlands in 2005 we did not find nests of any of the five County-listed species, although as noted above, we did not have the opportunity to conduct the focused search necessary to detect these consistently. Incidental to other field tasks, we happened to notice great blue heron and pileated woodpecker using several of the 103 visited wetlands (22 and 7 sites, respectively). Other animals noted by the field crew incidental to their other responsibilities, and the number of wetlands where found, were turtles (4 wetlands), western toad (3), frog (15; includes bullfrog, Pacific treefrog, red-legged frog), salamander or newt (4), salmon (2), dragonfly (45), ducks or geese (25), shorebirds (8), bald eagle (20), osprey (6), hawk (3), owl (4), beaver (8), and muskrat (4). Although not listed as threatened or endangered, the northern harrier (formerly called marsh hawk) is uncommon and possibly declining in Western Washington. It breeds mainly in large, lightly-grazed or ungrazed pastures and large emergent wetlands that flood only briefly. In the early 1990's approximately half the nesting sites in Western Washington were located in Island County, primarily on Naval Air Station lands (EA Engineering, Science, & Technology 1996).

The local Audubon Society and other groups have identified nine Island County wetlands as being of particular note for the variety and abundance of birds observed, and the BICC has recognized these legally as "Habitats of Local Importance" (Ordinance C-78-00). They are: Bos Lake, Crockett Lake, Deer Lagoon, Newman Road Lakes, Cultus Bay Flats, Whidbey Island Game Farm, Penn Cove, Hastie Lake, and Useless Bay. During our 2005 field work we assessed small parts of some of these, but did not systematically survey their wildlife. These listed wetlands are mainly ones that are visible from the road. There is no evidence to support an assumption that some other Island County wetlands (especially some not accessible to or viewable by the public) are of less health, functionality, or value than the recognized nine.

5.4 Wetland Water Quality

Water and sediment quality are some of the most important indicators of wetland health and function, but as is true of most other jurisdictions, existing data from wetlands is lacking and difficult to collect. The County's non-estuarine wetlands will be included in the newly-adopted Countywide water quality monitoring program that begins later in 2006 (Adamus et al. 2006).

Water quality has been measured at various times and locations by federal, state, and/or County agencies in thousands of Island County wells, and in a few lakes and streams. All water quality data linked to geographic coordinates was identified, and locations within mapped wetlands or within 100 ft of mapped wetlands were noted and their data retrieved.

Approximately 25 of the 958 wetlands were associated with such data, and it included only nitrate (Figure 27) and chloride (Figure 28) measurements from wells. In addition, during summer 2005 we measured conductivity (specific conductance) in an additional 56 wetlands (46 non-estuarine, 10 at least partially estuarine) once per wetland, and those data are shown in Figure 29. Although very limited, these data show nitrate, chloride, and conductivity to be within the expected natural range for Western Washington. Although federal and state law includes wetlands under the definition of waters subject to water quality protection, neither the USEPA nor the State of Washington have adopted water quality standards that are specifically targeted to the unique physical, chemical, and biological environments of wetlands.

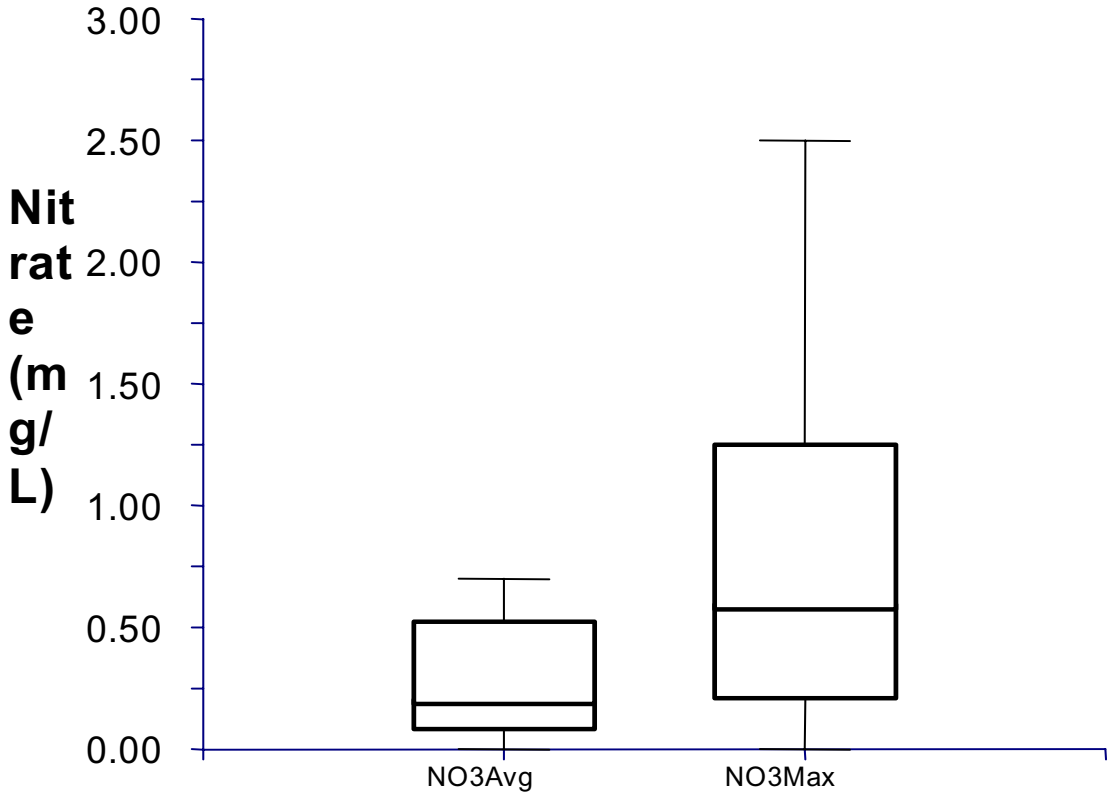


Figure 27. Average and maximum nitrate concentrations in wells located within 100 ft of 25 Island County wetlands

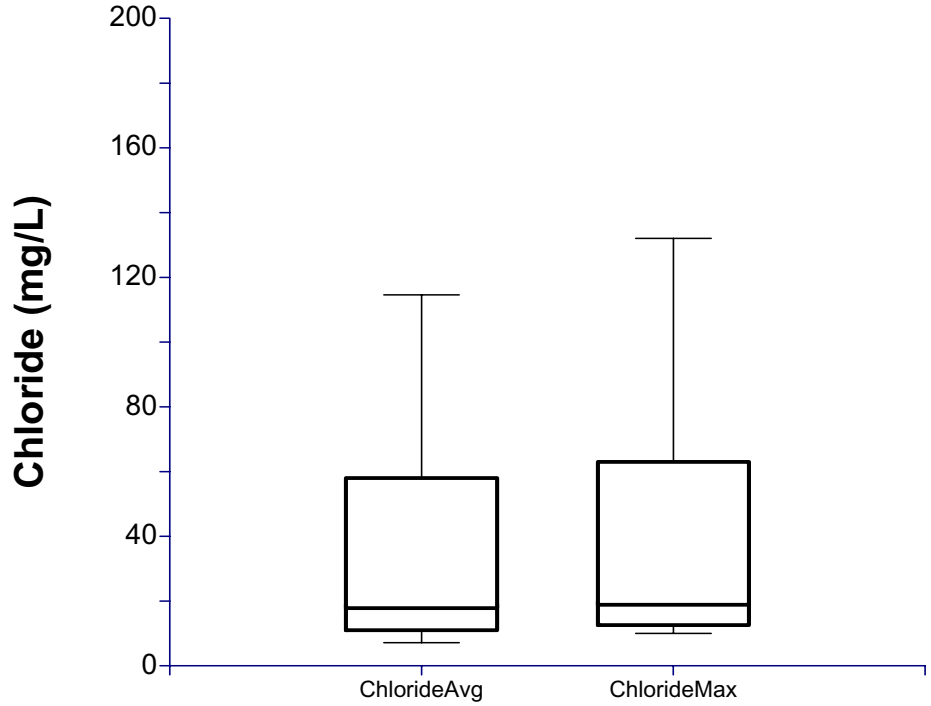


Figure 28. Average and maximum chloride concentrations in wells located within 100 ft of 25 Island County wetlands

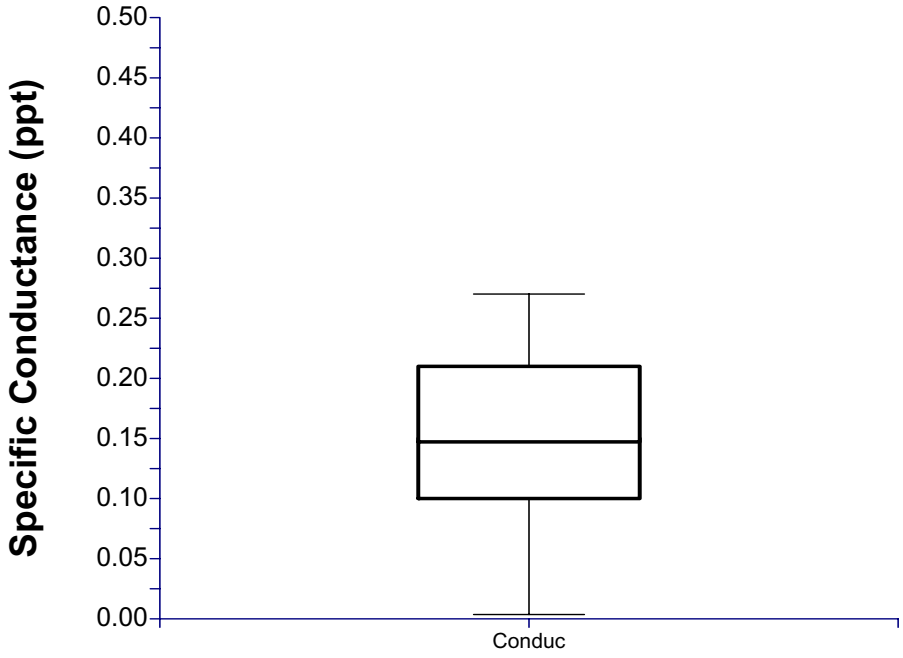


Figure 29. Specific conductance of surface water in 46 non-estuarine Island County wetlands visited during summer 2005

5.5 Wetland Alterations: Field Data

In addition to assessing botanical indicators of wetland health, the field crew noted ongoing or past alterations within each of the 103 visited wetlands (Table 20). See Appendix C3 for more information on procedures. Nearly all visited wetlands had evidence of some prior alterations but typically those alterations occurred long ago and/or occupied only a small portion of the wetland. For comparison, a survey of 164 Portland-area wetlands in 1992 found alterations in 81% (Kentula et al. 2004). Considering all time periods, the most common alteration within visited wetlands was logging (presumed to have occurred at least historically in all wetlands), followed by roads (in or alongside 38% of all visited wetlands), mowing (37%), pasture or lawn (36%), and excavation (34%, typically for creation of ponds) (Figure 30). Considering timing and extent of disturbance: the two activities that occurred most recently and covered the greatest extent of the wetlands were mowing and grazing. Logging is presumed to have occurred in most non-estuarine wetlands in the distant past, and throughout a large area of many wetlands. Excavation occupied a large portion of the wetlands in which it was present, and occurred historically. Most of the other alterations that are current/ongoing affect less than 1 to 10% of a wetland (Figure 30). The median distance of the visited wetlands to the nearest structure inhabited year-round was 150 ft.

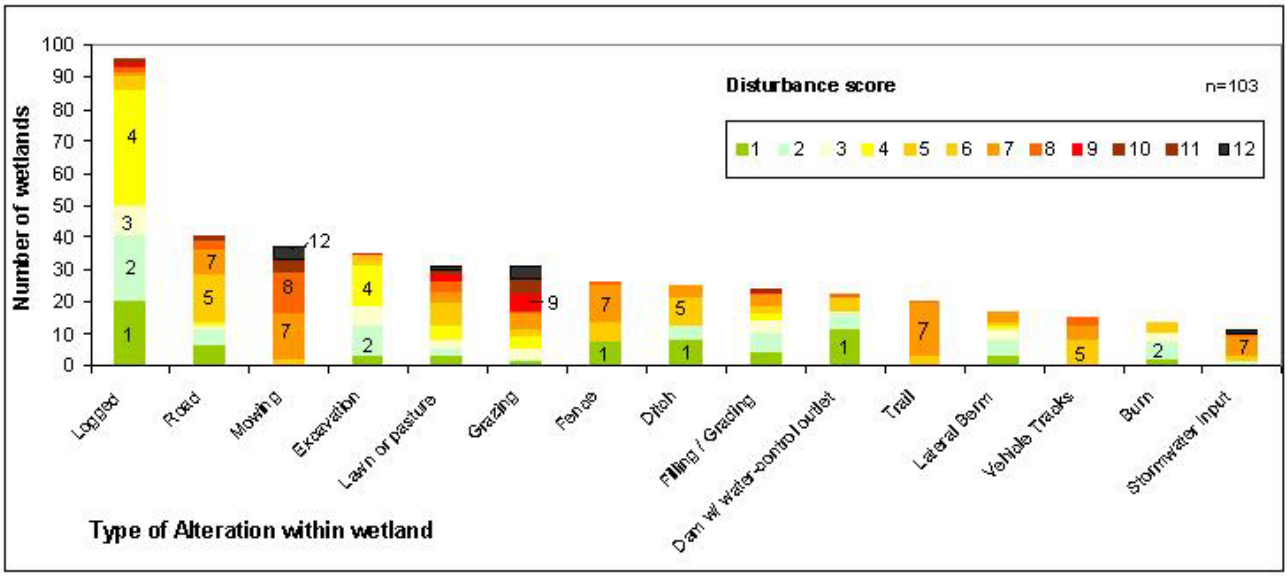


Figure 30. Number of visited Island County wetlands that have experienced alterations either historically or currently

Disturbance scores represent a combination of time period and extent of wetland affected by alteration. The following alterations were present in less than 10 of the surveyed wetlands: Channelization, spraying, sub-surface drainage, dam with no water-control outlet, crops, horticulture, reforestation, tillage, tree/shrub removal for right-of-way, and water removal

*Key to disturbance scores in the Figure above:

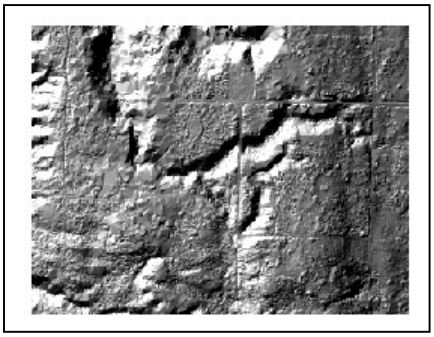
% of wetland	Ongoing	Recent Past	Distant Past
<1%	7	5	1
1-10%	8	6	2
10-50%	11	9	3
>50%	12	10	4

Table 20. Number of Island County wetlands with various types of alterations during three time periods, as noted in a sample of wetlands visited in 2005

Any alterations that were noted were assigned to their most recent period of occurrence (based on landowner comments whenever possible) and the maximum percent of the wetland polygon they occupied. When landowner was not available, the estimates were sometimes speculative.

Alteration	Current/ Ongoing: Extent				Recent Past (<20 yr ago): Extent				Distant Past: Extent				None
	<1%	1-10%	11-50%	>50%	<1%	1-10%	11-50%	>50%	<1%	1-10%	11-50%	>50 %	
Burned	0	0	0	0	2	0	0	0	2	5	3	0	87%
Channel modified	2	0	0	0	0	0	0	0	1	1	1	0	95%
Ditched	4	0	0	0	8	1	0	0	7	4	0	0	74%
Excavated	0	0	0	0	2	1	1	0	3	8	6	11	66%
Pasture/Lawn	4	2	0	1	3	3	2	2	3	3	3	4	64%
Fenced	10	1	0	0	6	0	0	0	7	0	0	0	74%
Grazed	5	1	3	4	1	1	4	2	1	1	2	4	69%
Drained	0	0	0	0	2	1	0	0	2	1	0	0	94%
Mowed	13	12	2	4	2	0	0	1	0	0	0	0	63%
Dammed (water control structure)	0	1	0	0	2	2	0	0	10	5	1	0	77%
Dammed (no water control structure)	0	0	0	0	0	0	0	0	2	3	2	0	93%
Diked	3	0	0	0	0	0	0	0	3	5	1	1	86%
Sprayed/Fertilized	0	1	1	1	1	1	1	1	1	1	0	0	90%
Cropped/ Tilled	1	1	1	0	0	0	1	1	1	0	0	1	92%
Garden/ Orchard	0	0	0	0	4	0	0	0	2	0	1	0	92%
Reforested	2	0	0	0	1	1	0	0	0	0	0	0	96%
Planting-- other	1	0	0	0	2	0	0	0	0	0	0	0	97%
Filled/Graded	4	0	1	0	1	1	1	0	3	6	2	1	78%
Riprapped	0	0	0	0	1	0	0	0	0	0	0	0	99%
Road/ driveway	8	3	0	0	9	4	0	0	6	4	0	1	62%
Stormwater	0	1	0	1	2	0	0	0	0	1	0	0	94%
Trail	13	1	0	0	0	2	0	0	0	0	0	0	83%
Trash Piles	6	0	0	0	6	1	0	0	2	0	0	0	84%
Logged	0	0	0	0	2	2	2	1	4	7	3	72	0%
Minor timber harvest	0	0	0	0	2	0	1	0	0	0	0	0	97%
Right of way clearing	3	0	0	0	2	2	0	0	0	0	0	0	92%
Vehicle tracks	3	3	0	0	6	0	0	0	0	0	0	0	87%
Water removal	4	1	1	0	1	1	0	0	1	0	0	0	90%

5.6 Wetland Alteration Assessments Using LiDAR and 1998 Aerial Photographs



The following describes our review of images of 696 wetlands, based on LiDAR imagery from 2001 with a resolution of about 6 horizontal feet, in conjunction with interpretation of an aerial photograph of the same area taken about the same time (1998). LiDAR is a technology that detects the topography of the ground surface from an aircraft. This review included side-by-side comparison with aerial photographs from close to the same time (1998). The aerial photographs were used mainly to assess the extent to which a tree canopy was lacking. LiDAR does not consistently detect this. Procedures and limitations of these data sources are discussed in detail in Appendix C5.

This analysis complements the previously-described analyses of aerial photographs from 1985, 1998, and 2001, by describing in greater detail the type and relative extent of alterations within wetlands. It does not provide information on *when* the alterations occurred, because LiDAR imagery was available from only one year (2001).

Evidence of alteration was found in 80% of the wetlands examined using LiDAR imagery in conjunction with 1998 aerial photographs. The alterations shown in Table 21 and subsequent LiDAR tables were based only on interpretations within wetlands, not their surrounding areas. For linear alterations (ditches, roads, fences, excavations), their relative extent within each wetland also was estimated subjectively but based on specific criteria described in Appendix C5. Of 420 wetlands (60% of total assessed) in which evidence was found of geomorphic alteration (e.g., fill, berm, dike, dam, ditch) in the LiDAR imagery, the average extent of modification within the wetland was estimated as 22%. Most geomorphic alterations occurred on the edge of the wetlands, and most clearings existed throughout the wetlands (Table 23).

Table 21. Alterations within Island County wetlands (n= 696) as noted in 2001 LiDAR imagery and/or 1998 aerial photographs

Note: The time period during which these alterations occurred could not be determined because no comparison was made between the LiDAR imagery and imagery from an earlier period (for details see section 4.2 and Appendix C5).

Alteration:	# of IC wetlands	% of all wetlands assessed where occurred to any degree
Clearing	310	44.54%
Ditch	193	27.73%
Pond (a)	190	27.30%
Building	124	17.82%
Driveway	103	14.80%
Berm (b)	101	14.51%
Road	53	7.61%
Paved road	52	7.47%
Fence	49	7.04%
Trail	45	6.47%
Excavation	45	6.47%

Alteration:	# of IC wetlands	% of all wetlands assessed where occurred to any degree
Field/mowed	36	5.17%
Fill	31	4.45%
Gravel road	21	3.02%
Altered channel	13	1.87%
Parking lot	7	1.01%
Airstrip	5	0.72%
Gravel pit	4	0.57%

(a) alternatively, the number is only 95 (14%) if just the ponds that occupy more than 40% of a wetland polygon are included (b) an unknown proportion of these are septic system drainfields

Table 22. Relative extent of geomorphic alterations within Island County wetlands as noted in 2001 LiDAR imagery (n= 689)

Note: The time period during which these alterations occurred could not be determined because no comparison was made between the LiDAR imagery and imagery from an earlier period (but see section 4.2).

Relative extent of linear alteration:	# of wetlands	% of all wetlands assessed where occurred at level described
No Linear Alterations Noted	263	38%
Low	251	36%
Moderate	104	15%
High	77	11%

Table 23. Location of various types of alterations within wetlands as noted in 2001 LiDAR imagery (n= 689)

Note: The time period during which these alterations occurred could not be determined because no comparison was made between the LiDAR imagery and imagery from an earlier period (but see section 4.2).

	Center	Edge	Throughout
Clearing	47	105	154
Road	80	138	23
Buildings	23	66	15
Other Geomorphic (fill, ditch)	101	181	52

Of 95 or more wetland polygons that are at least 40% comprised of artificial ponds, the average extent of the wetland occupied by the pond was estimated as 73%. Of 441 wetlands (63% of total assessed) with evidence of vegetation alteration in the LiDAR and/or the 1998 airphoto, the average score for such alteration within the wetland was 3.7 on a scale of 0 (no alteration) to 10 (nearly complete alteration) with 56% of the wetlands with scores of less than 5. Considering all 696 wetlands assessed using 2001 LiDAR and/or the 1998 airphoto, the disturbance score (which accounts for the disturbance type, location, and extent within the wetland, see Appendix C5 for details) averaged 3.06 when vegetation disturbance was included (Figure 31) and 1.57 when it was not. These figures paint a general picture of geographically extensive but individually relatively-mild alteration to the County's wetlands, originating at unknown times in the past.

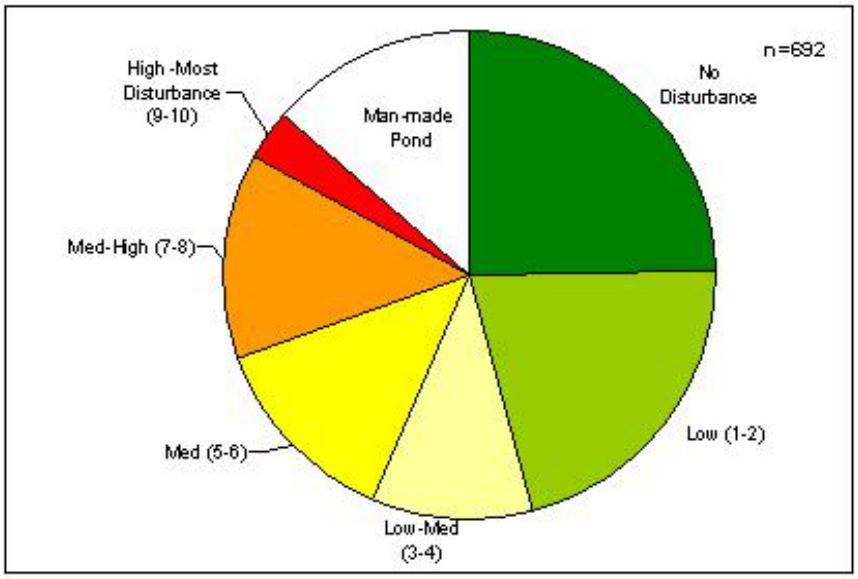


Figure 31. Proportion of wetlands with each intensity of disturbance

Note: Score is in parentheses. Disturbances include both linear alterations as noted in 2001 LiDAR imagery and vegetation alterations, both within the wetland as noted in 1998 aerial photographs.

By querying the databases that we have assembled, all of the above statistics could be broken down further by wetland size, geomorphic type, vegetation type, zoning category, likely protection category (A, B, C, etc.), surrounding land use, soil type, connectivity to other wetlands and estuaries, and/or other variables listed in Appendix B.

5.7 Wetland Alterations Described by Existing Spatial Data

5.7.1 Information from WDNR's Timber Harvest Database

Another potential source of information on wetland alterations is WDNR's timber harvest database. The WDNR, in some cases joined by the ICPCD, reviews applications for timber harvests on private or public land in Island County, and requires buffers around streams and wetlands[23]. WDNR has maintained a geographically-referenced database of permit applications. The extent of timber harvests that might have occurred in wetlands since about 1996 (the earliest year data were entered in a database) is shown in Table 24 and Figure 32. However, because of geographic imprecision in the data, and because of uncertainty regarding whether approved harvests actually took place, caution is warranted before making definitive interpretations. If desired, these statistics could be broken down further by querying the databases we assembled and subtotaling them by wetland size, geomorphic type, wetland vegetation type, zoning category, likely protection category (A, B, C, etc.), surrounding land use, soil type, connectivity to other wetlands and estuaries, and other variables listed in Appendix B.

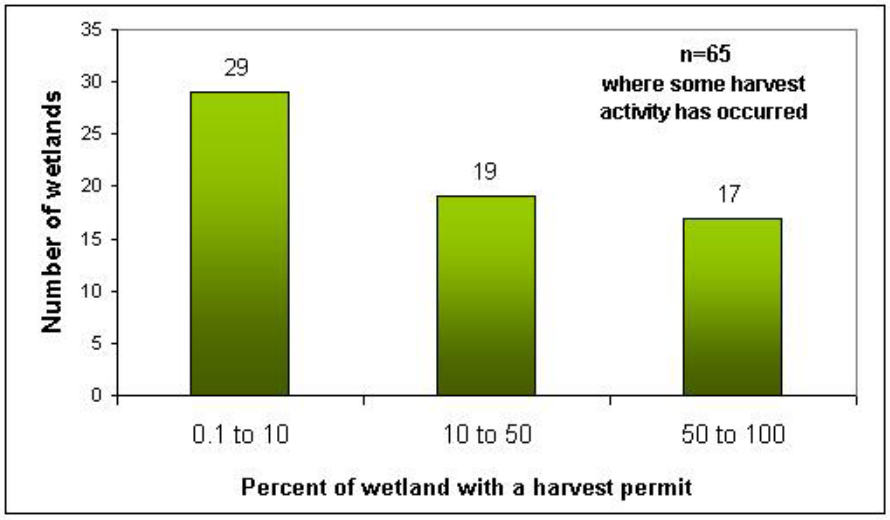


Figure 32. Number of wetlands and percent of wetland potentially affected by timber harvest permits issued in Island County, 1996-2004

Table 24. Timber harvest permits for Island County wetlands, 1996-2004

Wetland ID06	Acres authorized for cut	% of wetland* authorized for cut
3	1.76	100.00
15	0.37	3.21
28	0.90	60.34
29	0.45	0.45
35	0.52	0.15

[23] Since 1998 timber harvests potentially affecting critical areas are reviewed by both ICPCD and WDNR. The WDNR mostly requires 25-50 ft buffers around wetlands smaller than 5 acres, and 50-100 ft if larger than 5 acres.

Wetland ID06	Acres authorized for cut	% of wetland* authorized for cut
42	0.37	1.83
45	1.20	3.18
97	0.28	14.89
99	1.21	2.60
126	1.10	14.78
190	15.14	6.51
202	2.71	41.72
207	0.43	3.42
208	1.00	21.55
222	1.25	6.31
224	2.02	24.66
226	0.12	58.73
227	0.09	3.06
230	1.76	18.02
246.1161	3.79	1.87
271	8.27	100.00
281	1.14	13.69
282	3.51	14.88
283	1.17	5.56
291	21.22	100.00
292	2.36	46.99
294	4.37	92.21
305	0.08	0.13
313	0.01	0.02
316	0.10	0.71
318	0.88	8.84
333	0.29	3.80
336	0.26	30.01
338	0.09	4.13
340	1.87	17.23
341	0.03	0.85
344.1089.0.2	2.42	4.06
377	8.15	56.04
382.1170.0.2	0.05	0.31
398	3.96	0.66
411	0.17	0.82
425	0.14	1.22
429	0.04	0.33
484	2.97	60.53
575	0.44	13.59
693	0.14	6.09
1014	0.84	77.52
1026.644	2.15	55.71
1032	2.65	74.23
1034	0.10	64.14
1045	1.04	32.35
1058	1.11	28.31
1062.0.2	0.10	18.00
1066	1.15	87.27
1074	0.20	45.16
1080	1.17	40.26
1123.0.1	0.58	97.59
1147	0.01	3.20
1169	0.34	19.60

Wetland ID06	Acres authorized for cut	% of wetland* authorized for cut
1188	0.04	4.48
1189	0.04	7.38
1195.0.1	0.35	94.08
1195.0.2	0.05	34.52
1196	0.40	99.55
1238	0.00	0.85
1245	0.85	90.10

* wetland boundaries and size not confirmed by field delineation

5.7.2 Information on Alterations as Mapped by NWI

NWI maps also contain information on wetland alterations that were visible to the persons who interpreted the 1970's aerial photographs that were used to prepare the maps. NWI provides this information partly by appending modifier codes to the wetland attribute code. An advantage of this information is that, unlike the permit files and aerial imagery we examined, it depicts alterations that specifically occurred prior to the County's 1984 Wetlands Protection Ordinance. A disadvantage is that detecting alterations was not a primary objective of those who created the NWI maps, and alterations were noted only from aerial photographs. Compilations are shown in Table 25.

Table 25. Extent of wetland alterations prior to the mid-1970's, as mapped by NWI in Island County

Note: These figures are major underestimates of actual conditions, partly because NWI maps show fewer than 62% of the wetlands in Island County (only 44% by area).

	Number (# and % of wetlands mapped by NWI)	Acres (% of wetland area mapped by NWI)
Partially Drained/ Ditched	17 (2%)	573 (4%)
Diked/ Impounded	13 (1%)	456 (3%)
Excavated (includes many ponds)	188 (20%)	221 (2%)
Artificially Flooded	5 (1%)	41 (1%)
Other Ponded*	19 (2%)	191 (1%)

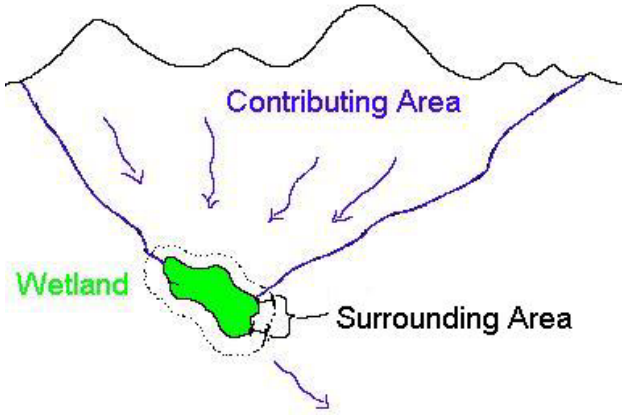
* unconsolidated bottom or shore in polygons with no codes indicating vegetation

The NWI maps indicate that at least 211 (22%) of the County's wetlands had been modified or created by artificial impoundment, ditching, diking, or excavation prior to the 1984 ordinance. For ditching specifically, our interpretation of the LiDAR imagery (section 5.6) found evidence of ditching in 27% of the wetlands as opposed to only the 1% identified by NWI. This likely is due to the greater ability of LiDAR to detect ditches, as compared to the NWI which used coarse-resolution aerial photographs.

5.8 Alterations to Wetland Contributing Areas and Surroundings

Wetland health is influenced not only by alterations that have occurred directly within a wetland, but also by alterations that have occurred in the vicinity of wetlands. To assess this influence, for this study we delimited the "vicinity" of each wetland in two ways:

1) Contributing Area: This includes the variously-sized, primarily upland area that contributes water to an individual wetland, either as runoff, channel flow, or groundwater. It includes areas from the "ridge line" downhill to the outlet (or lowest point in) of the wetland, and may include other wetlands located upgradient from the object wetland but none located downgradient. Sometimes this is called the "wetland basin," "wetland watershed," or "wetland catchment" – although these often encompass downgradient areas as well. Contributing areas were delimited digitally for each of the County's 926 non-estuarine wetlands. Double-counting of the acreage of features within nested contributing areas was avoided when summing data Countywide. The concept of contributing area is less meaningful for estuarine wetlands because of the large influx of Puget Sound water they typically receive, so the contributing area was not delineated for estuarine wetlands.



Contributing Area v. Surrounding Area. The contributing area is the geographic area that contributes water to a wetland . The surrounding area is the area around the wetland, it is not necessarily in the contributing area.

2) Surrounding Area ("surroundings"): This area is defined by a series of 7 concentric rings radiating outward in all directions from a wetland's upland boundary, and may include some lands located downgradient of a wetland. In the digital layer, the rings were spaced at 25, 50, 75, 100, 150, 200, and 300 ft from each wetland's boundary, and the areas between the rings are termed "zones." Under Island County's current CAO regulations, the first four zones (out to 100 ft) are of most interest as wetland "buffers," with minimum width specifications depending on a wetland's type, size, and zoning designation. The zones of proximate wetlands sometimes intersect and overlap; this was taken into account when summing some of the data in this report so that some features would not be double-counted.

Figure 33. Aerial photograph of a wetland showing Contributing Area, Surrounding Area, and buffer transect

Existing spatial data were used to describe alterations within the Surrounding Area and Contributing Area of each wetland. Conditions in the Surrounding Area were described further by field data collected along a "buffer transect" through the 1-150 ft zone of most of the 103 visited wetlands. If additional analysis of the quality of the Contributing Area is warranted, aerial photographs and LiDAR images could be interpreted for that area as well.

5.8.1 Results from Field Visits

We characterized the area surrounding each wetland during visits to 103 Island County wetlands. Using a randomly-placed transect that began at the mapped wetland-upland boundary and ran for 150 ft in an uphill direction, we recorded conditions along the transect up to a distance of 150 ft from the mapped wetland boundary, to the extent we could access such areas or view them from the wetland (see Appendix C3 for detailed description of procedures). Results are presented in Table 26, Figure 34, Figure 35, Figure 36, Figure 37, and in Appendix D7.

These data comprise a baseline for defining the currently "normal" conditions in areas surrounding Island County wetlands.

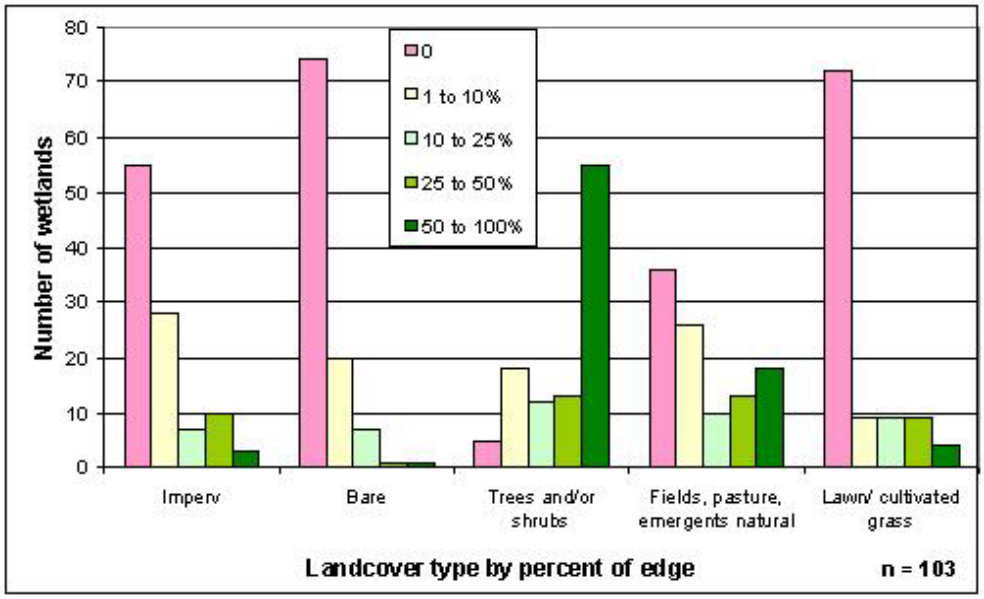


Figure 34. Number of visited Island County wetlands with land cover type and extents along their perimeter

These data show the buffer zones and surroundings of most Island County wetlands to be in a relatively natural condition. In the zone closest to the wetlands (0-25 ft), a tree canopy with coverage exceeding 50% is present at more than half the sites. Only 1% of the wetlands had more than 10% impervious surface in that zone, and only 2% had more than 10% bare soil there. Moving farther out from a wetland, these percentages barely change. Within 100 ft of the wetland boundary, at least one large-diameter (>21 inch) tree was present in 38% of the wetlands, one large snag was present in 16%, and at least one large log was present in 28%. Also, along the transect extending uphill 100 ft from the wetland boundary, non-native plants comprised at least 20% of the cover at 42% of the sites. For comparison, a visual estimate of non-native plants throughout that zone (not just where the transect intersected it) indicated that buffers of 48% of the wetlands had such an extent of non-natives in that zone, and the mean percent cover of non-natives there was 31%. Noxious plant species were present in the 0-100 ft buffer of 56% of the wetlands but comprised only about 1% of the cover. See Appendix D7 for additional data summaries.

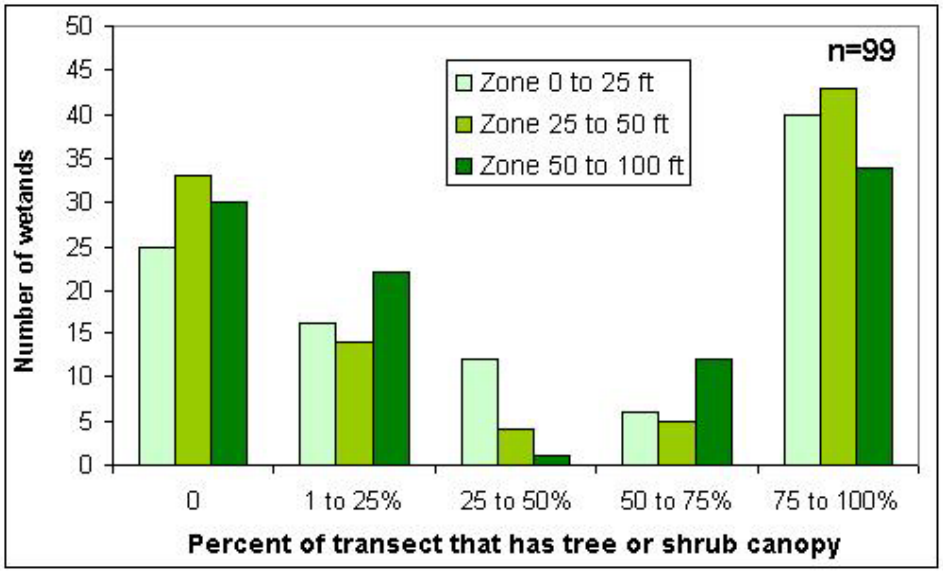


Figure 35. Number of visited wetlands with various percentages of tree or shrub canopy within the buffer transect

Table 26. Presence of habitat features and non-native plants along transects at various distances from visited Island County wetlands (n= 99)

# of visited wetlands where criteria were met on transects that passed through the:	0-25 ft zone	25-50 ft zone	50-100 ft zone	100-150 ft zone
Live trees with diameter >21 inches	21	20	21	17
Standing snags with diameter >20 inches	5	7	4	9
Logs >12 inch diameter and >20 ft long	18	18	20	15
Non-native plants: 1+ species having >20% cover along the transect as it passes through the specified zone	35	33	36	38

Note: Numbers of large trees, snags, and logs were not counted; only their presence was noted. No standards are available for evaluating what is an adequate number of such features in a wetland or surrounding areas, but there is general agreement that the more large trees, snags, and large logs there are in a wetland and its surrounding area, the higher is the potential habitat function. In contrast, as the cover of non-native plants increases (last row), habitat function for would normally decline.

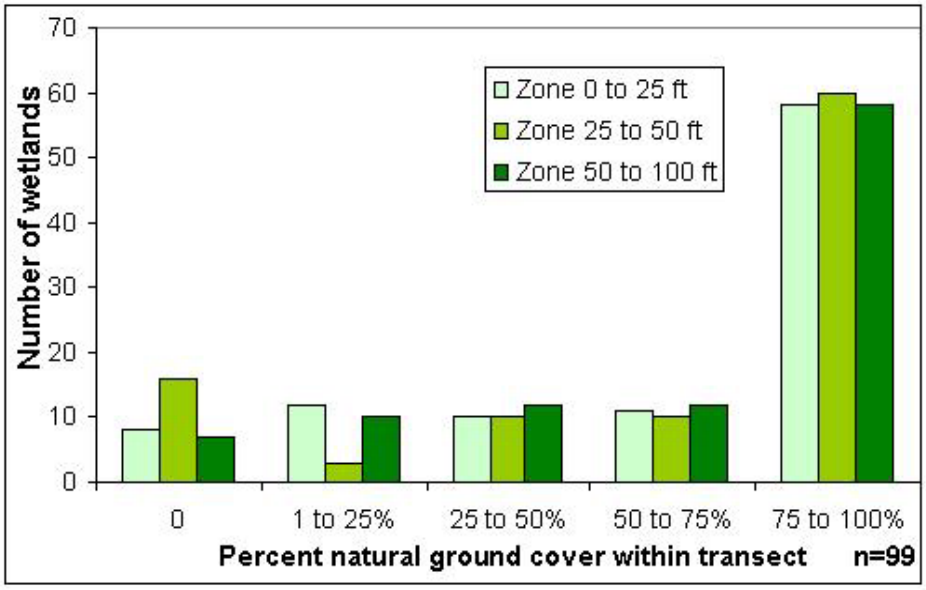


Figure 36. Number of visited wetlands with various percentages of natural ground cover within the buffer transect

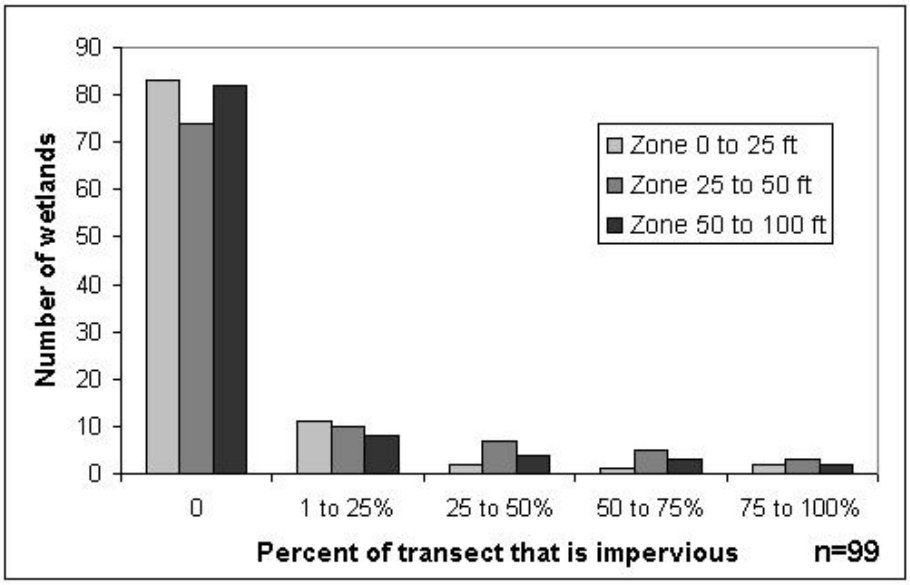


Figure 37. Number of visited wetlands with various percentages of impervious surface within the buffer transect

In addition to the transects, the zone surrounding wetlands out to 100 feet was examined for alterations in all field-surveyed wetlands. The most common alterations were roads, pasture, tree/shrub removal and lawn (Figure 38).

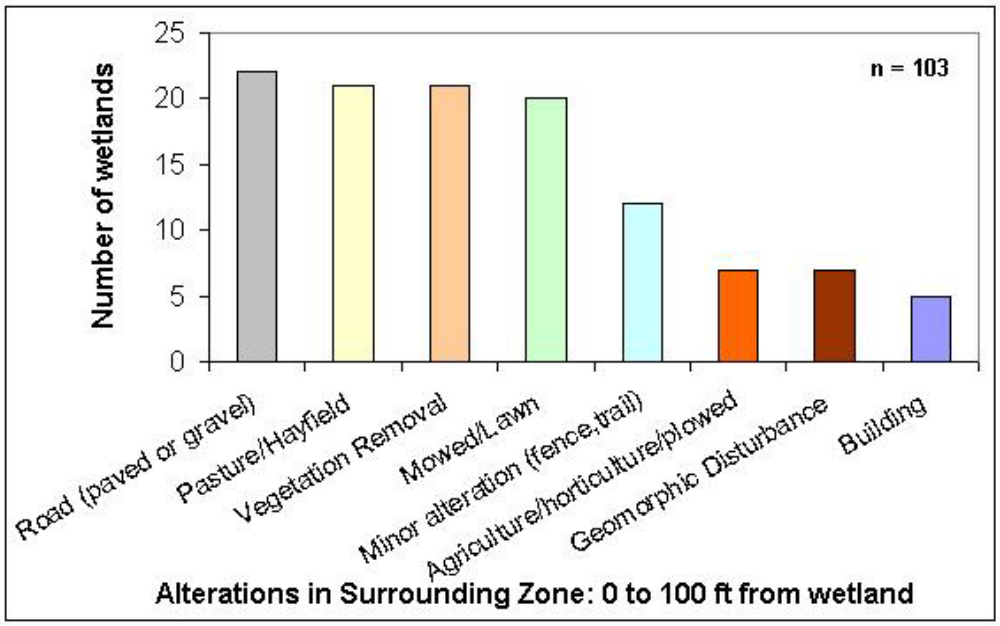


Figure 38. Alterations to surrounding zone (portion not included in transect)

Note: These data cover only the zone within 100 ft of the wetland because areas farther away could seldom be adequately viewed around the entire wetland perimeter, due to obstructing vegetation and need for accessing additional properties.

5.8.2 Results Based on Existing GIS and File Data

Due to the potentially important influence of wetland surroundings on wetland health, digital data were compiled and analyzed for the zones surrounding each wetland as well as for the wetland's contributing area.

Contributing Areas

Roads are present in the contributing area of 84% of the non-estuarine wetlands. Among all non-estuarine wetlands, the average road density (both unpaved and paved) is 35 linear ft per acre of contributing area, with a maximum of 1,469 linear ft per acre.

County-designated "Critical Drainage Areas" are present in 99 (10%) of the contributing areas and when present, comprise an average of 42% of the contributing area. Zoning categories and land cover types in the contributing areas are shown in Table 27 and Table 28. The average slope of non-estuarine contributing areas is 10%, with an average maximum of 45% slope. Contributing areas are comprised of an average of 9 (NRCS estimate) to 21% (WDNR estimate) hydric soils.

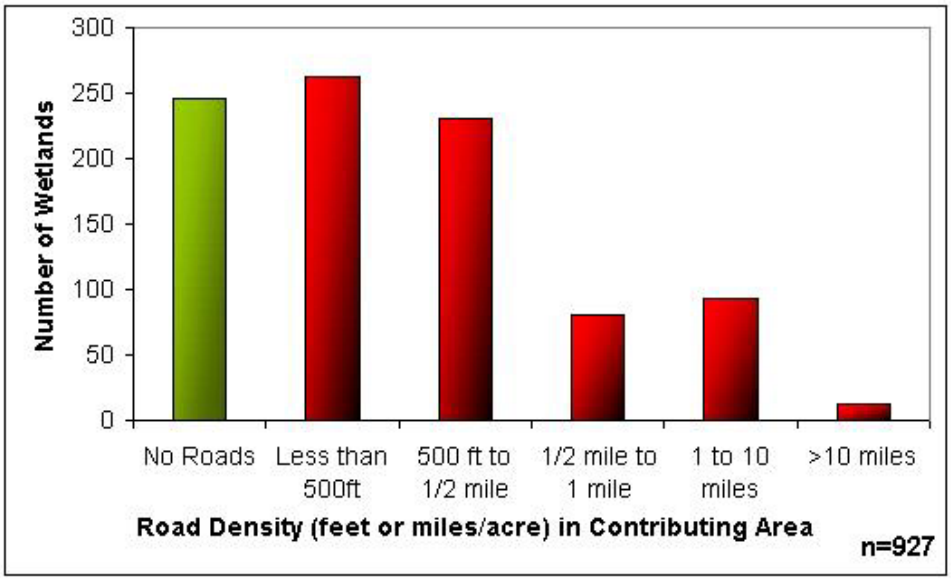


Figure 39. Number of non-estuarine wetlands with various road densities in their Contributing Areas

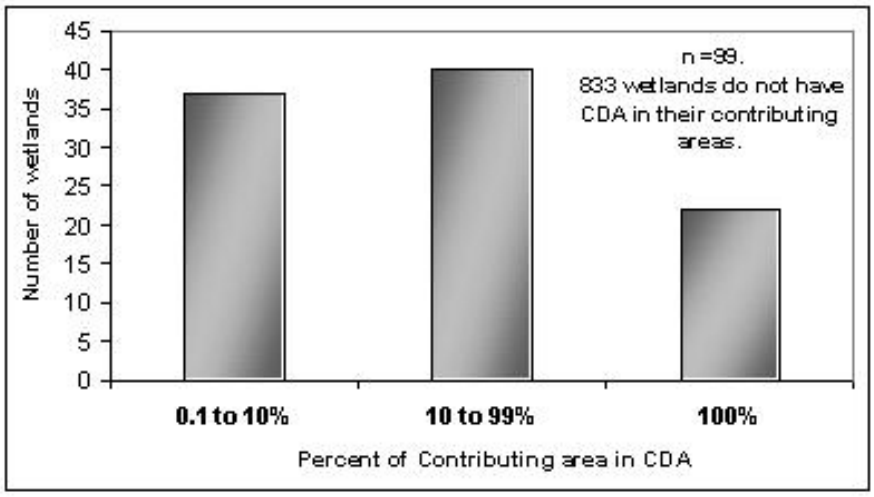


Figure 40. Number of non-estuarine wetlands with various percentages of "Critical Drainage Area" within their Contributing Area.

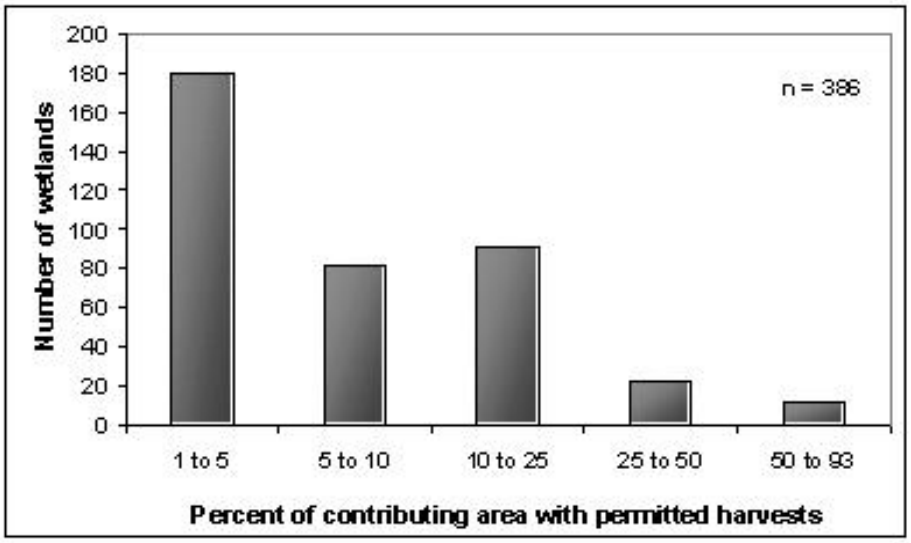


Figure 41. Number of non-estuarine wetlands with permitted timber harvest (1996-2004) in various percentages of their Contributing Area

Since about 1996, the WDNR (and more recently, Island County) has authorized timber harvesting within 66 wetland contributing areas in the County (Figure 41). Not all authorized cuts are actually implemented. The average cut authorized comprised 11% of a contributing area (maximum= 94%).

In the future, the spatial data compiled for the contributing areas by this project should be used in sediment and nutrient delivery models to predict runoff volumes and contaminant loading to individual Island County wetlands. An optimal site-specific approach might involve recompiling data in zones extending out from the wetland within its contributing area, with greater weight being given to parts of the contributing area closest to a wetland and/or on steeper and/or more impervious slopes. The spatial data and modeling also might be used to recommend property-specific BMP's when access to property

cannot be gained for field verification, or when the potential consequences of a specific BMP applied Countywide or to specific wetland settings and categories needs to be determined.

Table 27. Zoning categories associated with Contributing Areas of non-estuarine wetlands

Zoning Category	Acres in contributing areas	%	# of contributing areas with any of that category	%	# of contributing areas where that category dominates	%
Rural	117827	64.62%	824	86.01%	699	72.96%
Rural Forest	18744	10.28%	297	31.00%	41	4.28%
Rural Agriculture	10982	6.02%	245	25.57%	46	4.80%
Municipality	7967	4.37%	58	6.05%	23	2.40%
Federal Land	7511	4.12%	70	7.31%	29	3.03%
Commercial Agriculture	7288	4.00%	78	8.14%	8	0.84%
Rural Residential	7020	3.85%	158	16.49%	62	6.47%
Park	2267	1.24%	50	5.22%	16	1.67%
Airport	967	0.53%	17	1.77%	0	0.00%
Rural Center	732	0.40%	28	2.92%	4	0.42%
Review District	613	0.34%	11	1.15%	0	0.00%
Rural Village	250	0.14%	20	2.09%	2	0.21%
Light Manufacturing	147	0.08%	6	0.63%	0	0.00%
Rural Service	20	0.01%	12	1.25%	0	0.00%

Table 28. Land cover classes associated with Contributing Areas of non-estuarine wetlands, from 1998 satellite imagery

Land Cover (1998)	Acres in contributing areas	%	# of contributing areas with any of that category	%	# of contributing areas where that category dominates	%
Grass Short	23945	13.13%	834	89.58%	226	24.27%
Shrub Deciduous	19839	10.88%	805	86.47%	166	17.83%
Shrub-Ag Mix	18618	10.21%	676	72.61%	171	18.37%
Forest Evergreen Open	15836	8.69%	688	73.90%	127	13.64%
Shrub Forest	11452	6.28%	759	81.53%	50	5.37%
Rural Lawn	10504	5.76%	783	84.10%	36	3.87%
Shrub Evergreen	9676	5.31%	768	82.49%	15	1.61%
Developed Low Density	9164	5.03%	772	82.92%	29	3.11%
Shrub & Grass	8140	4.46%	698	74.97%	29	3.11%
Grass Sparse	7632	4.19%	637	68.42%	14	1.50%
Forest Mixed	5969	3.27%	670	71.97%	9	0.97%
Wetland Emergent & Shrub	5442	2.98%	747	80.24%	6	0.64%
Grass Urban	4997	2.74%	638	68.53%	9	0.97%
Developed High Density	3888	2.13%	576	61.87%	13	1.40%
Developed Low Density & Shrub	3657	2.01%	610	65.52%	8	0.86%
Forest Shrub-Grass	3479	1.91%	449	48.23%	4	0.43%
Wetland Shrub	3437	1.89%	674	72.40%	4	0.43%
Forest Open & Shrub	2962	1.62%	416	44.68%	2	0.21%
Wetland Emergent (non-estuarine)	2220	1.22%	608	65.31%	1	0.11%
Forest Evergreen	2112	1.16%	427	45.86%	0	0.00%
Forest Deciduous	1647	0.90%	576	61.87%	1	0.11%
Shrub Urban	1581	0.87%	379	40.71%	3	0.32%
Wetland Forested	1260	0.69%	532	57.14%	0	0.00%

Land Cover (1998)	Acres in contributing areas	%	# of contributing areas with any of that category	%	# of contributing areas where that category dominates	%
OpenWater	1064	0.58%	75	8.06%	0	0.00%
Riparian Vegetation	941	0.52%	439	47.15%	2	0.21%
Wetland Emergent & Forest	715	0.39%	391	42.00%	0	0.00%
Developed Low Density & Grass	613	0.34%	165	17.72%	4	0.43%
Mowed	591	0.32%	229	24.60%	2	0.21%
Bare	484	0.27%	267	28.68%	0	0.00%
Open Water Shallow	349	0.19%	127	13.64%	0	0.00%
Wetland Emergent Estuarine	91	0.05%	100	10.74%	0	0.00%

Surrounding Area

When based only on GIS delineations using digital spatial data, the lines separating zones as narrow as the seven defined in this report are quite imprecise. Thus, for most variables we compiled spatial data in four broader zones: 0-50, 50-100, 100-150, and 150-300 ft. In light of the additional imprecision of the wetland boundaries themselves, the following results should be considered approximations.

Roads are present within the 0-50 ft zone surrounding 35% of the wetlands, within the 50-100 ft zone surrounding 48%, within the 100-150 ft zone surrounding 55% of the wetlands, and within the 150-300 ft zone surrounding 71%. County-designated "Critical Drainage Areas" are present in 9% of the areas within 300 ft of wetlands. Zoning categories and land cover types in the surrounding areas are shown in Table 29 and Table 32. Since about 1996, the WDNR has authorized timber harvest permits in areas surrounding wetlands as shown in Table 31. High-susceptibility aquifers are present around 27% (0-50 ft zone) to 35% (150-300 ft zone) of the wetlands. At more than 75% of the wetlands, hydric soils extend beyond the wetland boundary, with the percent of the surrounding zones comprised of hydric soil declining as expected with distance from the wetland. Priority species and habitats reported by WDFW to occur within 300 ft of Island County wetlands include:

Bald Eagle…….…….surroundings of 237 wetlands
Shorebird Concentration Areas……..surroundings of 7 wetlands
Waterfowl Concentration Areas…….surroundings of 51 wetlands
Cavity-nesting Waterfowl…….……..surroundings of 2 wetlands
Wood Duck Nesting Habitat……...surroundings of 1 wetland
Riparian Areas……surroundings of 29 wetlands
Mature Forest……..surroundings of 2 wetlands
Band-tailed Pigeon Nesting Habitat…surroundings of 5 wetlands

Table 29. The dominant zoning category in areas surrounding Island County wetlands

	# of wetlands where dominates in 0-50 ft zone	# of wetlands where dominates in 50-100 ft zone	# of wetlands where dominates in 100-150 ft zone	# of wetlands where dominates in 150-300 ft zone	# of wetlands where dominates (average of zones)
Rural	636	635	644	647	66.39%
Rural Residential	87	89	86	86	9.08%
Rural Agriculture	60	59	58	58	6.26%
Federal Land	47	48	47	47	4.91%
Rural Forest	41	41	40	38	4.28%
Municipality	29	29	29	28	3.03%
Commercial Agriculture	22	23	20	21	2.30%
Park	15	14	15	15	1.57%
Rural Center	8	8	8	8	0.84%
Rural Village	7	7	7	7	0.73%
Review District	3	2	2	2	0.31%
Light Manufacturing	2	2	1	1	0.21%
Rural Service	1	1	1	0	0.10%

Table 30. Percent-slope in zones surrounding Island County wetlands

Zone:	0-25 ft	25-50 ft	50-100 ft	100-150 ft	150-300 ft
Average % Slope (a*)	12.29 (0-55)	11.70 (0-90)	10.67 (0-90)	8.88 (0-50)	
Average % Slope (b)	9.25 (2 to 45)		10.09 (2 to 43)	10.23 (2 to 44)	10.06 (2 to 31)
Average % Slope (c)	9.19		9.66	9.72	9.76
Minimum % Slope (c)	0.70		0.62	0.55	0.22
Maximum % Slope (c)	29.23		31.99	34.01	44.01

(a) average and range among only 98 visited wetlands, measured with a clinometer along 2 random transects extending perpendicularly through the zone from the wetland polygon boundary
(b) average among 98 visited wetlands, but measured with GIS for entire zone
(c) same as (b) but averaged just among all 958 wetlands

Table 31. Timber harvest permits (1996-2004) associated with zones surrounding Island County wetlands

Note: The spatial precision of these estimates is low, so harvests that appear to have been authorized close to wetlands may in fact have been farther away.

Zone:	0-50 ft	50-100 ft	100-150 ft	150-300 ft
# of permits	91	112	132	209
Average % of zone covered	0.71	0.68	0.68	1.80
Maximum % of zone covered	6.74	6.53	6.33	18.72

Table 32. Land cover along transects at various distances from visited Island County wetlands

	0-25 ft zone		25-50 ft zone		50-100 ft zone		100-150 ft zone	
	Average	# of sites where >10%	Average	# of sites where >10%	Average	# of sites where >10%	Average	# of sites where >10%
Impervious surface	4.45	10	6.31	14	7.72	17	7.07	19
Bare surface due to natural shading	9.80	17	6.67	16	7.87	14	5.41	11
Under a tree or shrub canopy	49.41	63	49.00	58	43.96	54	44.87	59
Natural herbaceous ground cover	70.40	92	71.07	83	67.65	82	69.22	78
Managed ground cover (e.g., lawn)	11.80	15	13.28	17	14.43	21	16.53	26
Water	0.91	2	0.34	0	2.13	2	2.05	2

Table 33. Percent coverage of habitat features throughout entire zones at various distances from visited Island County wetlands as inventoried along transect

	0-25 ft zone		25-50 ft zone		50-100 ft zone		100-150 ft zone	
	Average	# of sites where >10%	Average	# of sites where >10%	Average	# of sites where >10%	Average	# of sites where >10%
1. Canopy of trees/shrubs	51.59	74	47.52	72	48.69	75	47.50	77
2. Lacking any live ground cover	9.82	22	12.26	28	10.51	26	9.20	23
3. Non-native plant species	31.59	50	30.68	57	31.92	60	32.09	60
4. Noxious plant species	2.61	4	1.84	2	1.64	1	1.64	1
5. Water	4.24	8	4.44	9	5.29	11	5.54	12

Note: No standards are available for evaluating what thresholds of the above variables are needed to support wetland functions or health, but there is general agreement that the less cover of non-native (3) and noxious plant species (4) , the greater the level of habitat function. An extensive canopy (1) favors some species but discourages others. Live ground cover (2) is generally beneficial for filtering sediment and pollutants before they reach a wetland.

5.9 Wetland Functions and Values: Western Washington Wetland Rating System

In a methodological document titled, *Washington State Wetland Rating System for Western Washington (Revised),* the Washington State Department of Ecology (Hruby 2004) published systematic criteria for defining important wetlands. The WDOE encourages use of this rating system by Western Washington counties involved in wetlands regulation. The system is a revision of a similar one developed in 1993, which was extensively peer-reviewed and used by consultants and agency wetland professionals. Revisions sought to improve the clarity and repeatability of the original version, as well as incorporate new scientific knowledge pertaining to indicators of wetland functions.

The system is one of dozens of peer-reviewed wetland function assessment methods developed throughout North America, so it cannot automatically be assumed to reflect best available science, or to be the only method that may do so. The consistency of results among users of all such methods has been questioned (Innis et al. 2000), yet there are no practical alternatives. Although far from perfect, these methods are best viewed as attempts to minimize non-systematic and arbitrary decision-making. They do so partly by improving the standardization of factors that should be considered when assessing wetland health and/or functions.

Use of the system's scoring procedures results in a wetland being assigned to one of four categories, with the highest ("Category I") reserved for wetlands that have a high cumulative score for "Water Quality Functions," "Hydrologic Functions," plus "Habitat Functions," and/or which have at least one of several "Special Characteristics." This is relevant because in related guidance (Granger et al. 2005), the WDOE suggests several alternative ways of calculating buffer widths they believe are appropriate for protecting these functions. For the wetlands we visited in 2005, Table 34 and Table 35 compare the category indicated by application of the WDOE Rating System with the category assigned using Island County's categorization scheme.

Table 34. Number of wetlands in each ICPCD wetland category corresponding to each WDOE Rating System category, by zoning

Note: This is from the 93 wetlands that are the random sample of wetlands that were visited and assessed in 2005. None of the visited wetlands were Category C.

Zoning classification	IC Category	DOE Category I	DOE Category II	DOE Category III	DOE Category IV
Rural	A	4	9	20	2
Rural	B	1	5	9	7
other	A	5	14	12	0
other	B	0	1	7	3
Total	A & B	10	29	48	12

Table 35. Percent (by area) in each ICPCD wetland category corresponding to each WDOE Rating System category, by zoning

Note: This is from the 93 wetlands that are the random sample of wetlands that were visited and assessed in 2005. None of the visited wetlands were Category C.

Zoning classification	IC Category	DOE Category I	DOE Category II	DOE Category III	DOE Category IV
Rural	A	7%	5%	17%	<1%
Rural	B	1%	14%	10%	2%
other	A	1%	29%	6%	0
other	B	0	1%	7%	1%
Total	A & B	9%	48%	41%	3%

Although the WDOE Rating System is simpler than many methods designed to assess wetlands rapidly, it integrates information on approximately 24 wetland characteristics, as opposed to only 4 in the case of Island County's categorization scheme[24]. At the risk of oversimplification, the main characteristics the WDOE System uses are summarized in Table 36.

Until this study, the revised WDOE rating system had not been applied in Island County (one Whidbey Island wetland was, however, assessed during testing by WDOE). The ICPCD has made no decision regarding future use of the WDOE Rating System by staff or consultants evaluating applications for alterations of wetlands, or for modifying the current legally-specified requirements for wetland buffer widths. While visiting several wetlands during this project we assessed the repeatability of the WDOE Rating System among two independent users, and results are summarized in Appendix D2. Concerns are often raised about the repeatability of results from structured rapid assessment methods such as the WDOE Rating System, yet no alternatives are currently available that have a better repeatability rate, are technically sound, and cover all major functions.

The scores and categories resulting from use of the WDOE Rating System are intended to represent only the relative degree to which a community might benefit from the services a wetland typically provides, those services being the storage and purification of water and the provision of habitat. Remarkably, the Rating System is structured such that wetlands that have more "Opportunity" to receive polluted water (such as from sources in agricultural and urban settings) are more likely to receive high scores and be assigned to a more restrictive category. Thus, higher scores and lower-numbered categories resulting from the WDOE Rating System must not be interpreted as necessarily representing the "best quality," "healthiest," or most sustainable wetlands. For 71% of the wetlands surveyed in Island County, the WDOE score for Water Quality Function doubled when the Opportunity component was included. Note that Water Quality Function does not describe the quality of water in a wetland, but rather, the capacity of the wetland to serve as a filter and processor of contaminated runoff.

Application of WDOE's Western Washington Wetlands Rating System suggests that most of the County's wetlands have characteristics that potentially allow them to purify polluted runoff and provide habitat to a variety of wildlife species at a level comparable to wetlands elsewhere in Western

[24] They are: zoning classification (Rural or not), size (3 categories), dominance by non-native plants, and special habitat features (e.g., estuarine)

Washington. Their average score for Water Quality Function is slightly lower than that for depressional wetlands elsewhere in Western Washington, but higher than for slope wetlands. Their average for Hydrologic Function is lower for both wetland types. Their Habitat Function score is about the same. On the WDOE Rating System's four-category scale and based only on our sample of wetlands, 10% of the County's wetlands fall in Category I (the highest), 29% in Category II, 48% in Category III, and 12% in Category IV. By area, 9% fall in Category I, 48% in Category II, 41% in Category III, and 3% in Category IV. Compared to elsewhere in Western Washington, slightly fewer Island County wetlands are in WDOE Categories I and II, for which WDOE recommends the largest buffers and protection[25]. However, comparisons with wetlands from elsewhere are very inexact because the Island County wetlands were drawn from a statistical sample whereas those surveyed elsewhere in Western Washington were hand-picked. Also worth noting is that in 12 trials comparing use of the Rating System by two trained persons assessing the same wetland, in 8 instances (75%) they independently arrived at the same category for the wetland. Details are provided in Appendix D2.

The WDOE has proposed several approaches for calculating appropriate widths of buffers around wetlands. One approach is based only on a wetland's assigned Category. As applied to our sample population of wetlands, this could result in a recommended buffer width of 225 ft for 30% of the County's non-estuarine wetlands, 110 ft for 56%, and 40 ft for 14%. A second WDOE alternative is based only on a wetland's score for Habitat Function. This could result in a recommended buffer width of 150 ft for 22% of the County's non-estuarine wetlands, and 100 ft for 78%. A third WDOE alternative combines the assigned Category with the score for Habitat Function. This could result in a recommended buffer width of 225 ft for 5% of the County's non-estuarine wetlands, 110 ft for 64%, 60 ft for 17%, and 40 ft for 14%. All the preceding figures assume a "moderate" impact from land uses in the buffer. Wider buffers could be expected if one of the most common buffer uses in Island County -- lightly-grazed pasture -- is considered a "high impact" use equivalent to industrial/ commercial land use, hobby farms, golf courses, and residential densities of more than 1 unit per acre. Conversely, somewhat smaller buffers could be expected if lightly-grazed pasture, especially when accompanied by other best management practices implemented under a farm management plan, is considered a "low impact" use, as forestry operations currently are. Currently, under the County's current Wetlands Protection Ordinance, 86% (at most) of the County's wetlands have required buffers of 100 ft, and 14% required buffers of 50 ft (Rural zone) or 25 ft (other zones)[26]. NRCS Best Management Practices (BMP's) specify buffers of at least 100 ft, depending on local conditions assessed during a visit.

In addition, Appendix D1 provides detailed breakdowns of the categories and scores, by the score distributions of their contributing functions and, at an even finer level, by the scores of the individual wetland characteristics that contribute to the functions. The reason for the greater proportion of wetlands in lower-value categories in Island County is unknown. One possibility is their relative lack of adjoining urban and agricultural land cover (which otherwise would raise their value as pollution filters, according to the WDOE Rating System). Another possibility is their lack of connectivity, due to the limits set by adjoining marine waters. Or Island County wetlands may simply have fewer features that otherwise are important for providing habitat. The wetlands surveyed for Island County were selected (randomly) as opposed to the WDOE wetlands (hand-picked), and the WDOE's selection process may have imposed some unknown biases. Note the higher proportion of Riverine

[25] Category I wetlands include but are not limited to bogs, relatively undisturbed estuarine wetlands, and wetlands associated with coastal lagoons or mature forest.

[26] Currently, categories (A or B) have been assigned tentatively to less than half of the County's wetlands. The percentages given here extrapolate from that limited and probably biased sample.

and Lacustrine in the WDOE data set, and the higher proportion of Slope, Coastal Lagoon, and Tidal wetlands in the Island County (IC) data set.

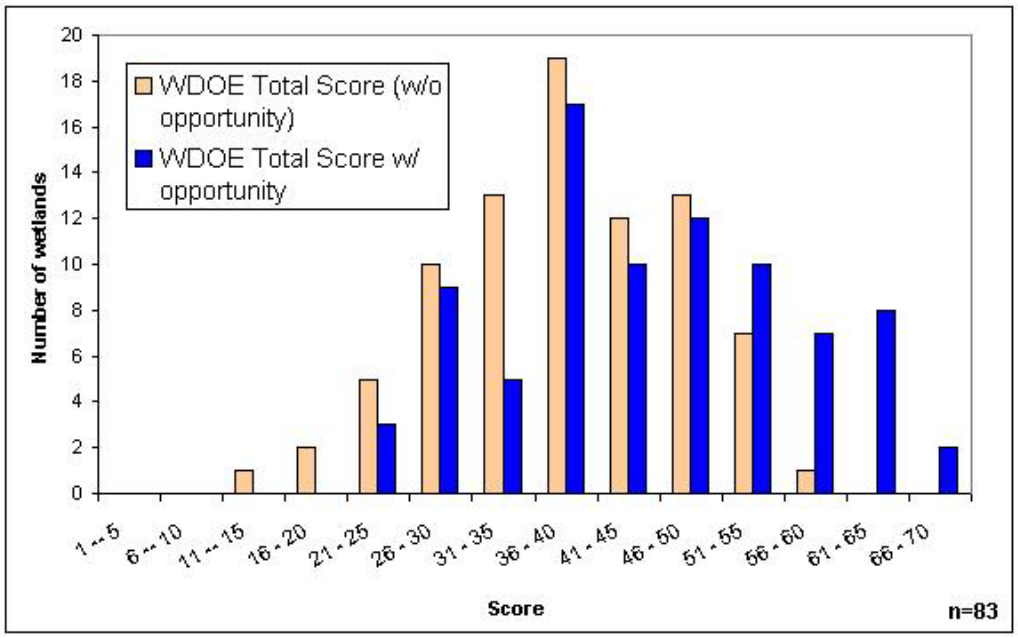


Figure 42. Number of visited wetlands with various total scores as assessed using the WDOE Rating System, with and without the Opportunity component

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Table 36. Simplification of characteristics used by the Western Washington Rating System to score wetlands.

For a full description see Hruby (2004). WDOE gives equal weight to the scores for Water Quality, Hydrologic, and Habitat Functions. Within each of those functions, not all of the listed characteristics contribute equally. WDOE uses the total score from the three Function groups to assign a wetland to a category (I= highest; IV= lowest), but any of the Special Features, if present, can be used to increase that category, e.g., from a III to I.
Asterisks (*) denote that a *preliminary* estimate of the feature might be obtained using aerial photographs, GIS, and widely available spatial data

Water Quality Function. Wetlands score higher if they:

a) are unconnected to streams* and are on slopes of less than 1%*
b) are located on organic (peat/muck) or clay soils*
c) have dense, persistent, ungrazed herbaceous vegetation over 90% of their area*
d) experience ponding of water only seasonally over more than half their area*
e) are located near potential pollution sources* ("Opportunity for Water Quality Function")

Hydrologic Function. Wetlands score higher if they:

f) are unconnected to streams*
g) increase in depth substantially with the onset of rain or are located in a headwater position
h) occupy an area equal in acreage to more than 10% that of their contributing area ("basin")*
i) are on a slope and contain:
    - Dense rigid vegetation that occupies over 90% of their area*

- Small surface depressions that retain water and cumulatively occupy at least 10% of the wetland's area

j) are situated upslope from or along a stream whose flooding has damaged property or resources* ("Opportunity for Hydrologic Functions")

Habitat Function. Wetlands score higher if they:

k) have all major vegetation structures (trees, shrubs, emergent plants, aquatic bed plants), each covering at least 0.25 acre or 10% of the wetland*

l) have 4 or more hydroperiod types, each covering at least 0.25 acre or 10% of the wetland

m) have more than 19 species of plants, excluding highly invasive non-native species

n) have high interspersion of multiple vegetation structures

o) have a variety of special habitat features including large logs, standing snags, undercut banks or overhanging vegetation, steep banks or signs of beaver/muskrat, thin-stemmed branches or grasslike vegetation that is partially submerged, and less than 25% cover of invasive non-native plants

p) are surrounded for over 95% of their circumference by a buffer of at least 330 feet consisting of ungrazed vegetation, rocky areas, or water*

q) are part of a relatively undisturbed and unbroken vegetated corridor that is at least 150 ft wide, has at least 30% woody cover or undisturbed prairie, and connects to estuaries or undisturbed areas at least 250 acres in size*

r) are within 330 ft of 3 or more of the following priority habitats: cliffs*, riparian areas*, mature forest, Oregon white oak stands, urban natural open space, estuary*, marine shoreline*

s) are located where there are at least 3 other wetlands within 0.5 mile and the connections between them are not interrupted by paved roads, fields, or development*

Special Characteristics: Wetlands score higher if they:

t) are estuarine and at least 1 acre in size with at least 2 of the following 3 attributes:

- relatively undisturbed by diking, ditching, grazing, etc.*
- have a buffer of at least 100 ft around at least 75% of their landward edge*
- have tidal channels, depressions with open water, or contiguous freshwater wetlands*

u) are Natural Heritage Program wetlands (support a state threatened, endangered, or sensitive plant species; or were recognized as being a high quality undisturbed wetland)*

v) are bogs (meeting specific criteria)

w) contain at least 1 acre of an area that meets WDNR criteria for "mature forest"

x) are located in a coastal lagoon (meeting specific criteria)*

6.0 Correlations Among Variables Assessed in Island County Wetlands and Their Surroundings

6.1 Introduction

The Results section that follows attempts to summarize narratively the results of 81,806 statistically-significant correlations found when pairing 820 major variables in our wetland database. A total of 671,580 unique pairs of variables were evaluated. ***It is critical to understand that statistical correlation does not mean causation.*** That is, just because two variables tend to occur together in the same wetlands and are correlated statistically does not mean a meaningful connection exists between them. A statistical correlation might be the result of both factors being correlated with a third (shared but unrelated) variable. Typically, features of the natural environment are influenced simultaneously by many features and can't be treated in isolation, yet it is often necessary to initially consider them in isolation in order to begin to understand and communicate their complex relationships.

About 33,579 of the statistically-significant correlations (41% of all those reported) might have been due to chance alone because the probability level for the statistical procedure had been set at 5%. The procedure used was the Spearman rank correlation test, which is most suitable for application to data such as ours that were not normally distributed in a statistical sense. The mean r-value (correlation coefficient) of the 81,806 significant correlations was only 0.22, their mean p-value was 0.01, and their mean "n" was 510 for the negative correlations and 567 for the positive ones. The range of values over which each correlation is applicable can be inferred from Appendix D7. It should also be noted that from a statistical perspective, the County's wetlands were treated as individual records independent of one another, when in reality there exists a high degree of spatial autocorrelation (i.e., wetlands closer to each other are more likely to be more similar), and that can challenge the assumptions of many statistical tests. Fortunately, the Spearman rank correlation test used here is relatively immune to that bias.

Many of the implied relationships described below seem obvious. Many are well known among wetland scientists and in some cases the public. We nonetheless report them because, to our knowledge, this is the first time they have been documented statistically to exist among wetlands in Island County. Of course, not all of the 81,806 significant correlations could be summarized narratively. The ones reported below were the ones that seemed least redundant and pertinent to wetland management. A database containing all the statistically significant correlations is available in electronic format upon request from the ICPCD. Although many of the correlations below are described quite briefly, additional explanation of the variables can be found in Appendix B. Many could be subject to multiple interpretations of their meaning and implications, so should be the subject to follow-up research and multivariate modeling when this is important. Although the relevance of every correlation may not seem immediately apparent, by profiling Island County wetlands they cumulatively contribute to our understanding of this resource.

6.2 Correlation Results

6.2.1 Within-Wetland Correlations Involving Alterations

This wetland study used various protocols to determine alterations that have occurred in wetlands. The following show correlations between alterations within wetlands and other conditions of those wetlands.

Correlations involving development within wetlands
The scores of all the **disturbance indices** based on 2001 LiDAR imagery were greater in wetlands where air-photos showed the most extensive *increase* had occurred in **clearing**, **roads**, **buildings**, and **ponds** within wetland and its nearest surrounding zone, 1985-1998.
Wetlands with more of their upland edge consisting of impervious surface had a greater percent cover and number of **non-native emergent plant species** and noxious species.
Wetlands classified as **high-density development** (based on land cover maps derived from 1998 satellite imagery) had fewer **dominant native species**, and were generally **wetter** as indicated by plant species composition. They also had more **emergent** species, **tree** species, and **noxious** plant species, with **non-natives** generally comprising more of the species list. **Tree cover** within the wetland was less than wetlands classified as having other land cover types.
Wetlands having the largest proportion of their area overlying **high-susceptibility aquifers** were also the wetlands with the greatest proportion of **Critical Drainage Area** and **high-density development** in and around the wetland, and the most **roads** within the wetland.

Correlations involving vegetation alteration within wetlands
Wetlands whose vegetation had more recently and/or extensively been **mowed** had greater percent cover of non-native emergent plants, and more noxious and non-native species.
Wetlands that had evidence of previous **burns** had more native species, native shrub species, and native tree species.
Wetlands that apparently have been **fertilized or sprayed with herbicides** had greater percent cover of non-native dominant species, non-native emergents, and had more noxious species.
Wetlands with a larger component of **salt-tolerant plants** were mostly estuarine wetlands, but also some with more of their upland edge consisting of **pasture or bare soil**.
The percent cover of herbaceous **non-native species** in the wetland was greater among wetlands with **open water** that received **less shade**, and which had more **lawn and/or pasture** along the upland edge.
Wetlands that recently had more **timber harvesting** had more native wetland species. They did not have more non-native species. Also, a larger proportion of their emergent plants were characteristic of wet conditions.

Correlations involving geomorphic disturbances within wetlands
Diked wetlands had more herbaceous species characteristic of wetlands.
Ditched wetlands had more total species and emergent species but also more percent cover of non-native emergent plants, more noxious species, and proportionally fewer wet species that were dominant.
Excavated wetlands (typically, manmade ponds) had more species and vegetation strata, as well as greater cover of aquatic bed plants, but also had more dominant noxious and non-native species, as well as greater percent cover of non-native emergent plants.

Correlations of factors associated with disturbance scores as determined by LiDAR and airphoto analysis
The scores of all the **disturbance indices** based mainly on 2001 LiDAR imagery were **higher** in wetlands that were larger, with a smaller percent of their area overlying low-susceptibility aquifer, with clay or muck soils, lower levels of function according to their WDOE category, more area zoned as Commercial Agriculture, Rural Agriculture, Federal Land, or Municipal, and more ditches, excavation, high-density developed, grazing, impervious edge, lawn edge, manmade land, roads, and/or mowed area. These disturbed wetlands had greater percent cover of non-native emergent plants and shrubs.
The scores of all the **disturbance indices** based mainly on 2001 LiDAR imagery were **lower** in wetlands at higher elevation, wetlands dominated by shrubs, steeper wetlands, wetlands with higher WDOE scores, wetlands zoned as Park or Rural Forest or Rural, and wetlands with a large seasonal component to their hydroperiod, multiple strata, woody cover along the upland edge, vegetation with affinity for wetter wetlands, and more noxious and non-native species.
The scores of all the **disturbance** indices based mainly on 2001 LiDAR imagery were **higher** in wetlands where field assessment of the *surrounding areas* **found more lawn and less tree canopy** within 50 ft of the wetland, and less likelihood of large-diametered trees and logs being in that area. These wetlands had greater percent cover of non-native species, and the surrounding areas were more likely to have non-native, often noxious, plant species.

6.2.2 Within-Wetland Correlations Involving Plant, Hydrological, and Geomorphic Features

Some correlations do not necessarily involve alterations to the wetland, but may reflect natural geomorphic and hydrological regimes within the wetland.

Correlations among plant, hydrological, and geomorphic features in the wetland
Larger wetlands had more plant species, native species, emergent species, and noxious species. They had less tree and shrub cover, and their plants tended to be species with stronger affinities for wetter wetlands. A larger proportion of their species were characteristically-wetland native species.
Larger wetlands also had larger contributing areas, were less likely to be flooded permanently, were on gentler slopes, and were less likely to overlie highly susceptible aquifers

Correlations among plant, hydrological, and geomorphic features in the wetland
Wetlands with a larger **peat** component in their soils had greater percent cover of woody vegetation.
Wetlands classified in the field as having proportionally more **seasonally-flooded** area had proportionally more **hydric soil**, more vegetation strata, and were more likely to be shrub wetlands.
Tree and shrub cover was greater in wetlands at higher **elevation**, with steeper **slope** and more **precipitation**.
Wetlands having more of their upland edge as trees and shrubs were at higher elevation, with more **precipitation**, steeper **slopes**, and **gravel soils**.
Wetlands with higher **conductivity** had fewer aquatic bed species, fewer vegetation strata, and fewer shrub and tree species.
The number of non-native shrubs was greater among wetlands with **shallower (or no) water**.
Wetlands with more **open water** had more native plant species that were dominant.
Water depth was greater in wetlands having more of their internal area classified as high aquifer susceptibility, as well as those with more precipitation, aquatic bed vegetation, permanent open water, and sandy soils. Water depth was less in shrub wetlands and/or those with proportionally more **hydric soil**.
Plant communities in wetlands having more **flat area** were comprised of more species with stronger affinities for wetter wetlands.
Wetlands with the largest proportion of their internal area classified as **bare** were unlikely to be shrub wetlands, more likely to be estuarine wetlands, and had proportionally less of their area as **hydric soil**.
A higher average wetness score of plants on a site's wetland species list (e.g., the proportions of obligate vs. facultative species), and especially the list of dominant species, confirmed the site's wetness, as reflected by **permanent flooding and deeper water.**
Among dominant species, those that were native wetland species comprised more of the species list in wetlands with a smaller proportion of their area **permanently flooded**, and more their **upland edge consisting of trees and shrubs**, with more **shading**.

Correlations among botanical variables
Wetlands with greater overall **percent-cover of non-native plants** had fewer native species, dominant native species, and emergent native species.
In wetlands with greater overall **percent-cover of non-native plants**, native species comprised a smaller proportion of the species list.
Wetlands with greater overall **percent-cover of non-native plants** tended to have species more characteristic of drier-end wetlands.

Water quality correlations
Higher average nitrate occurred in wells near wetlands that had less **woody cover** and more **"urban grass"** in their surrounding area, and more of the **aquifer** underlying their surrounding area was rated as highly-susceptible to contaminants.
Higher maximum nitrate occurred in wells near wetlands that were **permanently flooded** and had more **urban grass and evergreen forest** according to 1998 satellite imagery. More of the **aquifer** underlying their surrounding area was rated as highly-susceptible to contaminants. These wetlands had a high **WDOE score for water quality function**, calculated with and without the "opportunity" component of that score.
Conductivity of water samples from wetlands was greater where wetlands were at low elevation and had minimal slope. These wetlands had more buildings added in their vicinity during 1985-1998 and had proportionately more high-density development with more lawns, impervious surfaces, mowed areas, and roads. Many others were zoned as Commercial Agriculture or Rural Residential.

6.2.3 Correlations Involving WDOE Wetland Rating System

Based on results from applying the WDOE Rating System, wetlands with a **higher Total Score** were larger, flatter, with a larger contributing area, and were more likely to be:

(a) flooded seasonally or semi-permanently in flatlands,
(b) shrub wetlands,
(c) near developed (high and low density) areas or stormwater sources,
(d) overlaying highly-susceptible aquifers.

A larger proportion of their soils were hydric, they had greater internal diversity of vegetation types, were crossed by more roads and streams, and a larger proportionally of their upland edge had woody vegetation. They had less percent cover of non-native emergent and woody plants. The LiDAR interpretation found them to have a lower Disturbance Score, they generally lacked major excavation, geomorphic alteration was minor, and there had been less grazing.

6.2.4 Correlations Involving Wetlands and Zoning Classification

Larger wetlands were more common in areas zoned as Federal Land, as well as areas with recent timber harvests and/or areas with more high-density development in the surrounding area.
Percent cover of non-native emergent plants was greater in wetlands zoned as Commercial Agriculture and was less in those zoned as Park.
The **percent cover of emergent non-native plants** was higher in wetlands whose surrounding area is Commercial Agriculture or Rural Agriculture, while being less if zoned as Park.
Plants that typically are **wetland obligates** tended to occur more in wetlands whose contributing area is zoned as Rural Forest.
The **number of species classified as noxious** was greater in wetlands zoned as Rural Agriculture, Commercial Agriculture, Municipal, or Light Manufacturing.
The **dominant species** in wetlands whose contributing area is zoned as Rural tended to

be ones less characteristic of wetlands, i.e., more upland species.

6.2.5 Correlations Involving Changes in Wetlands between Time Periods

The following correlations among data show how changes in land use relate to wetland condition during the two time periods.

Correlations based on alterations noted in aerial photographs, 1985 – 1998
In wetlands where comparison of 1985 vs. 1998 airphotos showed more extensive between-date **clearing of vegetation**, there was greater occurrence of **noxious species** in the 0-100 ft wetland surrounding area.
In wetlands where comparison of 1985 vs. 1998 airphotos showed more extensive between-date addition of **buildings** in the surrounding area, there was more extensive **woody cover** in the surrounding area but also greater likelihood of there being **non-native species** in the 0-25 ft surrounding area, and noxious species in the 0-100 ft wetland surrounding area, but **less likelihood of large-diameter trees** in the 0-25 ft surrounding area.
In wetlands where comparison of 1985 vs. 1998 air photos showed more extensive between-date addition of **roads** to the wetland, there was more **bare soil** within the 0-25 ft surrounding area.
more **buildings** were added to the surrounding areas of wetlands that were **larger** and with a higher proportion of their area rated **low for aquifer susceptibility**.
more **buildings** were added in wetlands that were **larger**, had more **vegetation classes**, had seasonal or temporary hydroperiods, and where aquifer susceptibility was rated as low.
more **clearings** occurred within wetlands that were **larger**, had forest vegetation, multiple NWI classes, and located in watersheds with salmon.
more **ponds** were added in wetlands with less slope, **larger**, and with greater proportions of hydric soil.
more **roads** were added in wetlands with less slope, **larger**, more internal channel length, and multiple NWI codes.
In wetlands where comparison of 1985 vs. 1998 airphotos showed more extensive between-date addition of **roads** to the wetland, **large snags** were more likely to occur in the 0-25 ft wetland surrounding area.

6.2.6 Correlations Involving the Wetland-Upland Edge:

Grazed wetlands and those with more **lawn or pasture** along their upland edge had proportionally fewer native wetland plants as dominants, and those plants tended less to be wetland obligates. Such wetlands also had greater percent cover of non-native emergent and woody plants, and more noxious weeds.
There were more species of noxious weeds in wetlands that were permanently flooded or had deeper water, and more **pasture and lawn** along their upland edge.
Wetlands with **deeper water, permanent flooding**, and more **pasture along the upland edge** had more dominant species that were **non-native**, and they comprised more of the dominant species list
Total **plant species richness** was greater among wetlands that were **seasonally flooded** and those that had **pasture along their upland edge**.
Wetlands having more of their upland edge as lawn were more likely to be **permanently flooded.** Many of these were constructed ponds.

6.2.7 Correlations Involving Wetland Condition vs. Condition of the Surrounding Areas

Noxious plant species occurred mostly in wetlands that had mostly **lawn** in their 0-100 ft surrounding area.
Percent cover of non-native emergent plants was greater in wetlands whose surrounding area within 50 ft was mostly **lawn**, and had little **canopy** or **woody vegetation cover**.
Plant species richness (native species only) was less in wetlands having more **impervious surface** and **lawn** in the 0-100 ft surrounding area zone.
Wetlands with more **roads** in their 0-100 ft surrounding area had more noxious plant species, and more species characteristic of wetter wetlands.
Percent cover of aquatic bed vegetation was less in wetlands whose 50-100 surrounding area had more **impervious surface**.
A greater percent of the woody species were non-native in wetlands whose 0-50 ft surrounding area had more **impervious surface**.
Wetlands had **deeper water** if their surrounding area had large-diametered trees or proportionately more **lawn**.
Wetlands with **permanent flooding** and/or more **lawn along their upland edge** were more likely to have non-native plants in their surrounding area.
Non-native and noxious species comprised more of the wetland flora where surrounding areas are zoned as **Rural Agriculture or Municipal**, and less where zoned as **Park or Rural Forest**.
The number of shrub species was greater in wetlands whose surrounding area contained *less* cover of **lawn** and **impervious surface**.
Plant species richness (native species only) was greater in wetlands whose 0-100 ft surrounding area contained mostly **woody vegetation or tree canopy**
The number of plant species that are wetland obligates was greater in wetlands whose 0-100 ft surrounding area was **steeper** and with greater **canopy cover**.

The number of vegetation strata was greater in wetlands whose 0-50 ft surrounding areas contained less **impervious surface** and **lawn**, and had less cover of noxious plant species.
There were fewer dominant plants in wetlands whose surrounding areas had more **woody vegetation**
Wetlands that apparently had been **burned** were, in their surrounding area, more likely to have large-diametered trees and snags, and had generally more woody cover.
Wetlands that were **permanently flooded** were more likely to have non-native species dominating in the 0-25 ft surrounding area.
Composition of the emergent plant community suggested **wetter conditions** in wetlands whose 0-100 ft surrounding areas were **steeper**.
In wetlands that were **dammed**, the surrounding areas had more lawn and impervious cover, at least along surrounding area transect.
Wetlands whose outlets were **dams** had more bare ground in their 0-25 ft surrounding area.
In wetlands with more **ditching**, the surrounding area had less slope, was comprised more of lawn or pasture, and was more likely to have non-native species and noxious species, but less likely to have large-diameter trees and logs, and a tree canopy.
Wetlands that appeared to receive **stormwater** runoff were more likely to have non-native plants, lawn, and impervious surface in their surrounding area.
Where wetlands had more **grazing**, the surrounding area had more non-native and noxious species, and was less likely to have large logs and impervious surfaces.
Wetlands with more extensive or recent **logging** had less canopy but also less bare surface in their surrounding area.
Wetlands that had a greater proportion of **impervious edge** along the upland were less likely in their surrounding areas to have large logs and much tree canopy.

6.2.8 Correlations Among Conditions Within the Surrounding Areas

There was greater likelihood of finding **large-diameter trees, logs, and snags** near wetlands whose surrounding areas also are zoned as Park or Rural Forest, and less likelihood where zoned as Rural Agriculture.
The **tree canopy** in the surrounding area was more extensive when that area is zoned as Rural Forest, and less where zoned as Rural Residential, Rural Agriculture, or Commercial Agriculture.
More of the surrounding area contained **impervious surfaces** as expected where the surrounding area also is zoned as Municipal or Rural Residential, less where zoned as Rural Forest.
More of the surrounding area contained **lawn** when it is zoned as Commercial Agriculture, Municipal, or Rural Residential.
Wetland surrounding areas with the greatest **percent woody cover** are zoned as Rural Forest, and only rarely as Rural or Commercial Agriculture.
Wetland surrounding areas zoned as Rural Agriculture had **gentler slopes**.

6.2.9 Correlations of Wetland Conditions with Those in the Wetland Contributing Area

The following correlations occurred between altered *contributing areas* and wetland vegetation:

Wetlands whose contributing areas contained more **high-density development** (based on 1998 satellite imagery) had more **noxious plant species** and non-native wetland species, and non-natives comprised a greater percent of the plant species list.
Wetlands whose contributing areas contained more **timber harvest permit areas tended** to have more vegetation strata, a larger percent of their area as hydric soil, less slope, and more internal channels.
The percent cover of emergent non-native plants was higher in wetlands whose contributing area is zoned as **Rural Agriculture**.
The percent cover of emergent non-native plants and the number of dominating non-natives was higher in wetlands whose contributing area is zoned as **Commercial Agriculture**, but lower where zoned as Park.
Wetlands classified as **ditched** by NWI had more **roads** in their surrounding area and contributing area.

Some correlations do not necessarily depend on alterations in the contributing area, but may depend on geomorphic characteristics of the contributing area.

Wetlands whose contributing area contained a high percentage of **hydric soil** were less likely to be categorized as permanently flooded, were at lower elevations, had less slope, more NWI classes, and a higher percentage peat and muck soils.
Wetlands whose contributing area had **steeper slope** were smaller, had less hydric soil, had more internal channels, and higher aquifer susceptibility.
Wetlands whose contributing area had greater **aquifer susceptibility** had smaller wetlands, less hydric soil in the wetland, less extensive internal channels, higher elevation, greater precipitation, and steeper slope.
Wetlands whose contributing area had more **channel length** were larger, at lower elevation, with less precipitation, and had more hydric soil and diversity of vegetation classes and hydroperiods.
Percent cover of non-native emergents was greater where the wetland contributing area was at low **elevation** and had low **slope**.
The proportion of **native wetland species** that considered dominant within their stratum was greater in wetlands whose contributing area is zoned as Rural Forest.
The number of **native emergent plant species** was greater in wetlands whose contributing area is zoned as Rural Forest or Municipal.
Wetlands that are large relative to their contributing area had less proportion of their area as hydric soil, lower percentage of open water, more limited internal channels, and were less likely to have any permanent flooding. They were at higher elevation, had more muck and peat soil, and were more likely to be seasonally-inundated shrub wetlands.
Wetlands that are large relative to their contributing area had more plant species and emergent plant species.
Contributing areas that had a proportionally large area overlaying a **high susceptibility aquifer** had fewer noxious weed species, shrub species, and non-native emergents, as well as more species characteristic of the wettest types of wetlands.

7.0 Key Conclusions

1. Over 40% of the original wetlands in Island County have been converted to other uses. Almost all of those conversions occurred before the mid-1900's. Of the remaining wetlands, 80% show some signs of alteration but again, many of these alterations probably occurred before the mid-1900's. Almost half of the alterations were logging or other clearing of vegetation. Most covered only a small part of the affected wetland.

2. Based on our data from a limited number of indicators, the health of Island County's wetlands is generally good (Table 37 and Table 38). A quantitative baseline for future comparisons has been established.

3. Non-native plants include weeds, noxious plants, and others that can cause widespread harm to native plant communities, as well as damage to the habitat of some wildlife species and, in some cases, damage to gardens and agricultural lands. About 87% of the County's wetlands host some non-native species of plants. However, non-native plants dominate (cover most of the area within) only 20% of the wetlands. New data collected by this study show there being more non-native plant cover in wetlands that have been altered from a more natural state. Our data also show that when there is increased cover of non-natives in an Island County wetland, there is less variety of native plant species.

4. Since 1998, alterations (buildings, roads, clearings) were noticed in aerial photographs in only 8% of the wetlands, with the larger and more numerous alterations consisting of vegetation clearing rather than roads or buildings. Most of these alterations have affected only a small part of the wetland. Since the County began protecting wetlands in 1984, the County has authorized the alteration of less than 34 acres of wetlands. These alterations have been balanced almost equally by recovery of wetlands from alterations that occurred prior to 1984.

5. Also since 1984, the County has authorized the alteration of less than 28 acres of buffer area within 100 ft of wetlands. Since 1998, alterations noticeable in aerial photographs occurred in the 100-ft buffers of only 8% of the wetlands. Most alterations affected only a small part of the buffer, with the larger and more numerous alterations consisting of vegetation clearing. Since about 1996, timber harvests have been authorized within 100 ft of about 12% of the wetlands. Nonetheless, site inspections of a sample of wetlands found that natural ground cover dominates in the areas within 100 ft of 75% of the wetlands. In buffer areas closest to the wetlands (0-25 ft), tree canopy with coverage exceeding 50% is present at more than half the sites. Moving farther out from a wetland, this percentage barely changes. Only 1% of the wetlands had more than 10% impervious surface within their 100-ft buffer, and only 2% had more than 10% bare soil there.

6. Island County differs from other counties in that none of its wetlands occur along rivers or in river flood plains. Few are connected to streams directly but likely are connected to aquifers, streams, or estuaries by subsurface flow. More than ¾ are located in watersheds that drain into pocket estuaries. While few in number, the largest wetlands are the estuarine wetlands located on the shoreline. Most non-estuarine wetlands are on slopes or in depressions surrounded by sloping land (average slope within 100 ft is 10%), potentially making them more susceptible to conditions in their contributing area. A large number of the wetlands are man-made ponds or are associated with man-made ponds. Less than ¼ are located above highly susceptible aquifers. Slightly more than half of the County's non-estuarine wetlands completely lack year-round surface water. Such wetlands are at highest risk of invasion by non-native plant species. At least 19% of the County's non-estuarine wetlands are

dominated by trees or shrubs. Such wetlands are the most likely to be missed in the wetland mapping process.

7. Five of the seven plant species listed by the County as "Sensitive, Threatened, or Endangered" are associated more often with wetlands than uplands, as are 235 plant species (about one-third of the County's flora). About 18% of the bird, mammal, amphibian, and reptile species that regularly occur in Island County have a primary association with wetlands. WDFW-defined "priority habitats" associated with the County's wetlands include habitat for cavity-nesting ducks, wood duck nesting habitat, waterfowl concentration areas, shorebird concentration areas, bogs, and riparian areas. Animals species that are strongly associated with wetlands and are listed by WDFW and/or the County as Threatened, Endangered, Sensitive, or Locally Important include great blue heron, bald eagle, and osprey. Other wetland-obligate animals that may be highly sensitive to removal of forested areas surrounding wetlands include western toad, northern red-legged frog, and rough-skinned newt.

8. Application of the WDOE *Rating System* to a random sample of the County's wetlands suggested they have characteristics that potentially allow them to purify mildly polluted water and provide habitat to a variety of wildlife species at a level comparable to a non-random series of wetlands assessed elsewhere in Western Washington by the WDOE. Hydrologic function of the County's wetlands (as defined by the WDOE *Rating System*) is less common than the habitat and water quality functions of the wetlands because river flooding is unknown in Island County and the County's estuarine wetlands play no documented role in protecting shoreline property from coastal flooding.

9. Application of the WDOE *Rating System* to a random sample of the County's wetlands also assigned only 10% to the most protective category (Category I). This includes most of the County's estuarine wetlands, wetlands near mature forests, and bogs.

Table 37. Health (condition) of Island County wetlands: summary of results based on indicators used by this study

Note: The numbers in parentheses (columns 4-7) that define the qualitative ratings are solely the author's judgment, have no legal status, and are not based on research studies or data collected from reference sites proven to be unaltered. All results shown are from the sample wetlands assessed during site visits in summer 2005. Unmeasured indicators of wetland health include sedimentation rates, soil chemistry, sediment and water quality, water table dynamics, water level fluctuations in response to storm runoff, and reproductive success and usage of wetlands by fish and wildlife.

Indicator	Measure (in each case, less is assumed healthier)	Context	Percentage of Wetlands by Rating **(criterion in parentheses)**				Overall Grade
			Excellent	Good	Fair	Poor	
Non-native woody plants	% of woody cover*	in wetland	(0%) 34%	(1-5%) 52%	(6-10%) 7%	(>10%) 7%	Good
Non-native emergent plants	% of total emergent cover	in wetland	(<5%) 9%	(5-24%) 47%	(25-50%) 38%	(>50%) 6%	Good
Non-native emergent species	% of emergent species list	in wetland	(0) 10%	(1-20%) 54%	(20-29%) 26%	(>30%) 10%	Good
Non-native plants	% of dominant species that are non-natives	in wetland	(0%) 61%	(1-19%) 6%	(20-50%) 33%	(>50%) 0%	Good
Non-native wetland plants	# of species	in wetland	(0) 10%	(1-2) 26%	(3-5) 44%	(>5) 20%	Fair
Noxious plants	# of species	in wetland	(0) 9%	(1-2) 26%	(3-5) 32%	(>5) 35%	Fair
Noxious plants	# of species that are dominant	in wetland	(0) 72%	(1) 25%	(2) 4%	(3) 1%	Excellent

* calculated only for wetlands having >49% woody cover

Table 38. Alterations and/or potential stressors in Island County wetlands, contributing areas, and surroundings: summary of results based on indicators used by this study

Note: The numbers in parentheses (columns 4-7) that define the ratings are solely the author's judgment, have no legal status, and are not based on research studies or data collected from reference sites proven to be unaltered.

Data Sources (last column): AP05= comparison of 1998 and 2005 aerial photographs; GIS= existing digitized spatial data; LiDAR= interpretation of aerial LiDAR imagery; PF= ICPCD permit files; S100= site visits to a sample of wetlands

Indicator	Measure	Context	Percentage of Wetlands by Rating (criteria in parentheses)				Overall Grade	Data Source
			Excellent	Good	Fair	Poor		
Impervious %	% of all visited wetlands	wetland- upland edge	(0%) 55%	(1-5%) 18%	(6-15%) 9%	(>15%) 17%	Excellent	S100
Lawn %	% of all visited wetlands	wetland- upland edge	(0%) 70%	(1-15%) 12%	(16-30%) 10%	(>30%) 9%	Excellent	S100
Distance (ft) to nearest inhabited. building	% of all visited wetlands	up from wetland edge	(>900) 4%	(500-900) 8%	(100-400) 55%	(<100) 18%	Fair	S100
Building (built date unknown)	% of all wetlands	in wetland	(none) 82%	(near edge) 9%	(center) 7%	(thruout) 2%	Excellent	LiDAR
Ditching (date unknown)	% of all wetlands	in wetland	(none) 79%	(near edge) 11%	(center) 7%	(thruout) 3%	Excellent	LiDAR
Proportion of a wetland w. any geomorphic alteration (date unknown)	% of all wetlands with score	in wetland	(0) 33%	(.01-.10) 33%	(.11-.50) 29%	(>.50) 7%	Good	LiDAR
Disturbance score including vegetation alteration	% of all wetlands with score	in wetland	(0) 29%	(1-2) 24%	(3-5) 21%	(>5) 26%	Good	LiDAR
Land cover (dominant)	% of all wetlands	within 100 ft.	(natural) 37%	(other) 52%	(low dens. res) 8%	(high dens. res.) 3%	Good	GIS
Land cover (dominant)	% of all wetlands	in wetland contributing area	(natural) 40%	(other) 53%	(low dens. res) 6%	(high dens. res) 1%	Good	GIS

Indicator	Measure	Context	Percentage of Wetlands by Rating (criteria in parentheses)				Overall Grade	Data Source
			Excellent	Good	Fair	Poor		
High density developed %	% of all wetlands	within 100 ft.	(0%) 67%	(1-10%) 24%	(11-20%) 6%	(>20%) 3%	Excellent	GIS
High density developed %	% of all wetlands	in wetland contributing area	(0%) 37%	(1-10%) 56%	(11-20%) 6%	(>20%) 1%	Good	GIS
Road density (ft/acre)*	% of all wetlands	in wetland contributing area	(<2) 30%	(2-5) 1%	(6-100) 63%	(>100) 7%	Fair	GIS
Corridors & patch sizes WDOE Rating (H2.2)	% of all visited wetlands	surrounding area	(=4) 8%	(=2) 46%	(=1) 46%	(=0) 0%	Good	S100
Wetland proximity & connection WDOE Rating (H2.4)	% of all visited wetlands	surrounding area	(=5) 22%	(=3) 67%	(=2) 11%	(=0) 0%	Good	S100
Buffer width & disturbance WDOE Rating (H2.1)	% of all visited wetlands	surrounding area	(>3) 37%	(=3) 29%	(=2) 20%	(<2) 13%	Excellent	S100
Connectivity (sum of above 3) WDOE Rating	% of all visited wetlands	surrounding area	(>10) 13%	(8-10)) 28%	(6-7) 48%	(<6) 11%	Fair	S100
Lacking ground cover	% of buffer	within 100 ft	(<5%) 42%	(5-24%) 46%	(25-33%) (4%)	(>33) 8%	Good	S100
Tree/ shrub canopy	% of buffer	within 100 ft	(>90%) 18%	(60-90%) 23%	(5-59%) 49%	(<5%) 10%	Fair	S100
New clearing, 1998-2005	% of wetlands /yr Countywide	in wetland	(<0.5%) 100%	(.5-.9%) 0%	(1-5%) 0%	(>5%) 0%	Excellent	AP05
		within 100 ft	(<0.5%) 0%	(.5-.9%) 100%	(1-5%) 0%	(>5%) 0%	Good	AP05
New roads, 1998-2005	% of wetlands /yr Countywide	in wetland	(<0.5%) 100%	(.5-.9%) 0%	(1-5%) 0%	(>5%) 0%	Excellent	AP05
		within 100 ft	(<0.5%) 100%	(.5-.9%) 0%	(1-5%) 0%	(>5%) 0%	Excellent	AP05
New buildings, 1998-2005	% of wetlands /yr Countywide	in wetland	(<0.5%) 0%	(.5-.9%) 100%	(1-5%) 0%	(>5%) 0%	Good	AP05
		within 100 ft	(<0.5%) 0%	(.5-.9%) 100%	(1-5%) 0%	(>5%) 0%	Good	AP05
Timber harvest, 1997-2004	% of wetlands cut/ yr Countywide	in wetland	(<0.5%) 0%	(.5-.9%) 100%	(1-5%) 0%	(>5%) 0%	Good	GIS
		within 100 ft	(<0.5%) 0%	(.5-.5%) 100%	(5-10%) 0%	(>0%) 0%	Good	GIS
Recent grazing in >10% of a wetland	% of all visited wetlands	in wetland	(<1%) 96%	(1-5%) 4%	(6-10%) 0%	(>10%) 0%	Excellent	S100

Indicator	Measure	Context	Percentage of Wetlands by Rating (criteria in parentheses)				Overall Grade	Data Source
			Excellent	Good	Fair	Poor		
Recent excavation	% of all visited wetlands	in wetland	(<1%) 0%	(1-5%) 100%	(6-10%) 0%	(>10%) 0%	Good	S100
Recent fertilize or spray	% of all visited wetlands	in wetland	(<1%) 0%	(1-5%) 0%	(6-10%) 100%	(>10%) 0%	Fair	S100
Recent fill or grading	% of all visited wetlands	in wetland	(<1%) 0%	(1-5%) 0%	(6-10%) 100%	(>10%) 0%	Fair	S100
Road or driveway	% of all visited wetlands	by wetland	(<1%) 0%	(1-5%) 0%	(6-10%) 100%	(>10%) 0%	Fair	LiDAR
Stormwater input ditch/ pipe	% of all visited wetlands	in wetland	(<1%) 0%	(1-5%) 0%	(6-10%) 100%	(>10%) 0%	Fair	S100
Draining ditch	% of all visited wetlands	in wetland	(<1%) 0%	(1-5%) 0%	(6-10%) 100%	(>10%) 0%	Fair	S100
Permitted alterations, 1984-2005	acres/yr Countywide	in wetlands	(<1) 100%	(1-2) 0	(3-5) 0	(>5) 0	Excellent	PF
		in buffers	(<1) 100%	(1-2) 0	(3-5) 0	(>5) 0	Excellent	PF

* a road density of >4.95 ft/acre (0.6 mi/sq.mi) has been identified by some scientists as detrimental to mammals

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APPENDIX A. GLOSSARY AND ACRONYMS

Alteration. The addition to a wetland of manmade infrastructure or other observable human-related features or activities such as vegetation clearing, grazing or mowing. Alterations must not be automatically assumed to damage a wetland. Those that most closely resemble natural disturbances in their intensity, timing, duration, frequency, and extent are usually least likely to cause significant or irreversible degradation to the wetland. Used synonymously with "disturbance" in this document.
BAS. Best Available Science, a term with a specific legal meaning as defined under WAC 365-195-905(5)(b).
Berm: A raised earthen area parallel to a stream or perpendicular to a slope, constructed for the purpose of containing the stream flow during periods of high water, or raising the water table on a slope.
Best management practice (BMP). The physical, structural, and/or managerial practices that, when used singly or in combination, prevent or reduce pollution of water.
BICC. Board of Island County Commissioners.
Bog. A type of wetland dominated by mosses that form organic peat. Wetlands become bogs in settings where the climate and other factors allow the accumulation of peat to exceed its decomposition. Bog hydrology is dominated by precipitation rather than surface inflow. The plant community is specialized to survive in the nutrient-poor and highly acidic conditions typical of bogs.
Buffer. A generally terrestrial area surrounding a wetland and measured a specified distance outward from the wetland-upland line. As opposed to the more-inclusive *Surrounding Area,* the distance (width) is specified by existing laws and policies and may depend on wetland type, size, zoning category, and other factors. Buffers are intended to reduce impacts from adjacent land uses through various physical, chemical, and/or biological processes.
Canopy cover. The degree to which the foliage of the highest vegetation layer in a plant community blocks sunlight or obscures the sky.
Composite wetland polygon. A map unit comprised of the union of contiguous or overlapping wetland *polygons* (shapes) in current maps of the National Wetlands Inventory and Island County PCD. Each composite wetland polygon may contain several NWI polygons, each with a different code. These were the basic spatial units assessed by this project.
Connectivity. The structures on the landscape that facilitate movement of living organisms between patches or their habitat that are found across the landscape. The movement can occur either within the lifetime of an organism or over a period of generations. The purpose of facilitating movement is to maintain viable populations that allow species and communities of species to persist in time. Connectivity can be achieved via a continuous and linear habitat feature (as in a corridor or discrete habitat patches comprised of but not limited to individual forests, wetlands, shrub lands, and shorelines).
Contributing Area. The geographic area from which surface water drains to a particular wetland (see diagram, page 61). Typically begins at a ridge line and descends downward, including the wetland and ending at its outlet. Also called contributing *basin*. May include other wetlands if those are at higher elevation.
CAO. Critical Areas Ordinance.
CDA. Critical Drainage Area. A mapped sensitive area formally designated by the BICC where flooding, drainage, erosion, sedimentation, and/or instability hazards exist and the welfare and safety of the surrounding community would be threatened by increasing the volume and/or rate of surface water discharge from a developing parcel.
CTED. Washington State Department of Community, Trade, and Economic Development.

Depressional wetland. A class of wetlands in the hydrogeomorphic classification. These are wetlands that occur in topographic depressions that exhibit closed contour interval(s) on three sides and elevations that are lower than the surrounding landscape.

Emergent. Herbaceous plants that are rooted in the sediment but whose leaves are at or above the water surface.

Estuarine. Pertaining to estuaries, the semi-enclosed areas inundated at least occasionally by tides, where salt and fresh water mix dynamically.

Functions. What a wetland in its natural state does, as driven by the physical, biological, chemical, and geologic interactions among different components of a wetland.

Geomorphic. Pertaining to geologic composition and structure, e.g., topography, landforms, soils, and geology.

GIS. Geographic Information System, a computer-based approach commonly used to analyze maps and other spatial data sources.

GMA. Growth Management Act.

HGM. Hydrogeomorphic, referring to sources of water, geologic setting, and shape.

Health (of a wetland). The ability of a wetland to support and maintain (a) dynamic hydrogeomorphic processes within the range found in wetlands that are relatively unaltered, and (b) a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that found in relatively unaltered native habitats of the region, as influenced by (and influencing) the geomorphic processes described previously. Together, these define the ability to support and maintain wetland complexity and capacity for self-organization with respect to species composition, physical and chemical characteristics, and functional processes. A wetland may be considered to be healthy when all of its natural processes and parts are functioning within their natural ranges of variation. "Wetland health" in this report is used synonymously with wetland quality, integrity, and ecological condition.

Hydric soil. Soil that is wet long enough to periodically produce anaerobic conditions, thereby influencing the vegetation. Soil types (map units) have been officially labeled as hydric or not by the NRCS using specific physical criteria.

Hydrogeomorphic (HGM) classification. A system used to classify wetlands based on the position of the wetland in the landscape (geomorphic) setting, the water source for the wetland, and the flow and fluctuation of the water once in the wetland.

IC. Island County

ICPCD. Island County Department of Planning and Community Development

Impact. Changes to the environment that are caused by human disturbances. Impacts can be either beneficial or detrimental.

Lacustrine. Pertaining to lakes or lake shores.

LiDAR. Light Detection And Ranging. A technology that detects the topography of the ground surface from an aircraft, and the imagery resulting from that.

NRCS. National Resource Conservation Service (formerly the Soil Conservation Service).

NWI. National Wetlands Inventory, as conducted by the US Fish & Wildlife Service. The wetlands were identified on aerial photographs using vegetation, visible hydrography, and geography in agreement with systems defined in the document, *Classification of Wetlands and Deep-Water Habitats of the United States.*

Palustrine. Freshwater wetlands that are not riverine or lacustrine, such as marshes, forested swamps, wet pastures, and bogs.

Polygon. Any closed two-dimensional figure that is bounded by three or more line segments, like a square, circle, or irregularly-shaped figure. On maps, polygons often delimit the boundaries of areas that are somewhat homogeneous with regard to a particular characteristic.

Reasonable Use. A legal term dealing with the allowance for exemption from some CAO regulations when the County agrees that prohibition of the proposed use in a critical area would preclude reasonable economic return on the parcel as a whole when used for any purpose.
Restoration. The conversion of a non-wetland area to a wetland, in situations where documentation exists (e.g., from soil maps, old photographs) that all or part of the non-wetland area was once a wetland but was converted to non-wetland by human activities or infrastructure. Includes activities such as removal of fill, removal of dikes and berms that block water input to the area, plugging of drainage ditches, grading to resemble the site's original topography. Simple replanting of non-wetland areas, if it is the only action taken, may not qualify as wetland restoration.
Slope wetlands. A class of wetlands in the hydrogeomorphic classification**.** These are wetlands that occur on the slopes or close to the base of hills or valleys. The principal water source is usually seepage from groundwater.
Spatial Data. A map or data referenced according to latitude-longitude or other geographic features.
SPOT. Satellite Pour l'Observation de la Terre, a French company that distributes images from European satellites.
Storm water. That portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, pipes, and other features of a storm water drainage system into a defined surface water body, or a constructed infiltration facility.
Surrounding Area ("surroundings"). A generally terrestrial zone surrounding around a wetland and measured a specified distance outward from the wetland-upland line (see diagram, page 61). As opposed to the more-restrictive term, *buffer*, the distance (width) is not necessarily specified by existing laws and policies, but rather by data analysis objectives.
Topography. The shape of the land surface, e.g., elevational variation.
USEPA. United States Environmental Protection Agency
WAC. Washington Administrative Code.
WDFW. Washington State Department of Fish and Wildlife.
WDNR. Washington State Department of Natural Resources.
WDOE. Washington State Department of Ecology.
WRIA: Water Resource Inventory Area. Administrative and planning units that encompass large river basins. There are 62 WRIAs within the state of Washington. Island County is WRIA #6.
WSDOT: Washington State Department of Transportation.

APPENDIX B. DATA DICTIONARY

This is a listing of all variables compiled for Island County wetlands and/or their contributing areas and surroundings. The associated electronic files (column 1) have been archived as copy-protected Excel® files and are available from the ICPCD. For some variables, data have been compiled for all 958 composite wetland polygons, whereas for others data were available only for wetlands that were visited as part of this study, and/or were limited to geographic sections covered by the source of the spatial data. The last file in the list contains the statistical correlation coefficients generated by pairing most of the variables in this list.

Important Note: Many of these data were compiled by secondary sources using undocumented procedures. The ICPCD makes no warranty regarding the accuracy of any of these data.

File	Column	Variable	Description
WDB6	1	ID06	numerical identifier for composite wetland polygon, assigned in 2006
WDB6	2	ID05	numerical identifier for composite wetland polygon, assigned in 2005
WDB6	3	PointID	numerical identifier for sample point within the polygon (1= highest priority sample point/ polygon). Called SiteID in some files.
WDB6	4	Requested	1= a priority wetland sample point in the statistical sample. The landowner(s) of the wetland polygon were contacted. If Requested=1 and Visited=0, this indicates the landowner(s) did not grant access permission or did not respond.
WDB6	5	Visited	1= field data collected in 2005. If Requested=0 and Visited=1, this indicates this was not a priority sample point wetland in the statistical sample.
WDB6	6	IDcontribA	Identifier number for the wetland's contributing area (given only for wetlands with surface connections); the number is the ID06 code of the terminal wetland (the one "lowest in the chain")
WDB6	7	IDshedDom	Identifier number for watershed with which the wetland is primarily associated
WDB6	8	ShedNameDom	Name of watershed with which the wetland is primarily associated
WDB6	9	MergedPoly_	X= the ID06 polygon represents the union of multiple ID05 polygons
WDB6	10	SplitPoly_	S= the ID06 polygon represents the splitting or renumbering of a ID05 polygon
WDB6	11	AcresPoly	acreage of the composite wetland polygon
WDB6	12	AcContrib	acreage of the wetland's contributing area
WDB6	13	WetPctCA	composite wetland polygon acreage as a % of acreage of the associated contributing area
WDB6	14	WetPctShed	composite wetland polygon acreage as a % of acreage of the associated primary watershed
WDB6	15	IConlyAc	acres of the composite wetland that was mapped as wetland by Island County (1998) but not by NWI
WDB6	16	NWIonlyAc	acres of the composite wetland that was mapped as wetland by the NWI but not by Island County (1998)
WDB6	17	BothWetAc	acres of the composite wetland that was mapped as wetland by BOTH the NWI and Island County (1998)
WDB6	18	ICacTot	sum of IConlyAc and BothWetAc
WDB6	19	NWIacTot	sum of NWIonlyAc and BothWetAc
WDB6	20	IConlyPct	% of the composite wetland that was mapped as wetland by Island County (1998) but not by NWI

WDB6	21	NWIonlyPct	% of the composite wetland that was mapped as wetland by the NWI but not by Island County (1998)
WDB6	22	BothWetPct	% of the composite wetland that was mapped as wetland by BOTH the NWI and Island County (1998)
WDB6	23	ICpctTot	sum of IConlyPct and BothWetPct
WDB6	24	NWIpctTot	sum of NWIonlyPct and BothWetPct
WDB6	25	HydricDNRac	acres of the composite wetland that was mapped by DNR as hydric soil
WDB6	26	HydricDNRpct	% of the composite wetland that was mapped by DNR as hydric soil
WDB6	27	Hyd1pctNRCS	% of the composite wetland that was mapped by NRCS as hydric soil
WDB6	28	Hyd1_2NRCS	% of the composite wetland that was mapped by NRCS as hydric soil OR soil with potential hydric inclusions
WDB6	29	WetSystem	wetland system: NE= non-estuarine, ES= estuarine
WDB6	30	HGMclass	Hydrogeomorphic (HGM) class as defined by the WDOE Rating System. D= depressional, S= slope; R= riverine; L= lacustrine; E= estuarine. These determinations are much more reliable for visited sites ("1" in column 5). For the remainder, the class was estimated subjectively by examining DEM and LiDAR data for slope, flow accumulation, wetland as a percent of its contributing area, and stream connectivity.
WDB6	31	PeatPctAc	% of the composite wetland that was mapped by NRCS as peat soil (in the 1950's)
WDB6	32	MuckPeatPctAc	% of the composite wetland that was mapped by NRCS as muck soil (in the 1950's)
WDB6	33	SoilDomTyp	Mapping code (in County soil survey) of the dominant soil within the composite wetland polygon
WDB6	34	SoilDomPct	Percent of the wetland occupied by the dominant soil according to NRCS
WDB6	35	SlopeSoilDom	slope category of the dominant soil: 0= less than 5%, 1= 5 to 15; 2= >15
WDB6	36	SlopeDEM	mean slope of the wetland according to the DEM
WDB6	37	FlatLiDAR	estimated percent of the wetland that appears flat in the LiDAR image
WDB6	38	LandfSoilDom	land form category of the dominant soil: 0= tide flat; 1= beach; 2= flood plain; 3= terrace; 4= alluvial cone; 5= depression
WDB6	39	PeatDom	1= the dominant mapped soil within the wetland is peat
WDB6	40	MuckDom	1= the dominant mapped soil within the wetland is muck
WDB6	41	ClayDom	1= the dominant mapped soil within the wetland has a clay component
WDB6	42	SiltDom	1= the dominant mapped soil within the wetland has a silt component
WDB6	43	LoamDom	1= the dominant mapped soil within the wetland is loam or has a loam component
WDB6	44	SandFineDom	1= the dominant mapped soil within the wetland is fine sand or has a fine sand component
WDB6	45	SandDom	1= the dominant mapped soil within the wetland is sand
WDB6	46	SandCoarseDom	1= the dominant mapped soil within the wetland is coarse sand or has a coarse sand component
WDB6	47	GravelDom	1= the dominant mapped soil within the wetland has a gravel component
WDB6	48	GWhiAc	acreage of the composite wetland that coincides with an area mapped as a High Susceptibility Aquifer
WDB6	49	GWmedAc	acreage of the composite wetland that coincides with an area mapped as a Moderate Susceptibility Aquifer
WDB6	50	GWloAc	acreage of the composite wetland that coincides with an area mapped as a Low Susceptibility Aquifer
WDB6	51	GWhiPct	% of the composite wetland that coincides with an area mapped as a High Susceptibility Aquifer

WDB6	52	GWmedPct	% of the composite wetland that coincides with an area mapped as a Moderate Susceptibility Aquifer
WDB6	53	GWloPct	% of the composite wetland that coincides with an area mapped as a Low Susceptibility Aquifer
WDB6	54	Precip	annual precipitation (inches) in the vicinity of the wetland
WDB6	55	Elevation	elevation (ft) above mean sea level as based on DEM
WDB6	56	FlowAcc	wetland's flow accumulation value calculated using DEM (higher number = potentially wetter)
WDB6	57	CTI	wetland's compound topographic index (CTI) calculated from slope, flow accumulation, and other factors (higher number = potentially wetter)
WDB6	58	Curva	wetland's cross-sectional curvature as calculated using the DEM
WDB6	59	NumWetUp	number of wetlands located upgradient in this wetland's contributing area (subtract 1 from this value)
WDB6	60	NumWetDown	number of wetlands located downgradient in this wetland's contributing area (subtract 1 from this value)
WDB6	61	StreamFt	waters (ft) within the composite wetland mapped as streams by WDNR
WDB6	62	FishFt	waters (ft) within the composite wetland mapped as fish-bearing streams by WDNR
WDB6	63	Stream1	waters (ft) within the composite wetland mapped as "Type 1" (shorelines) by WDNR
WDB6	64	Stream2	waters (ft) within the composite wetland mapped as "Type 2" (high fish, wildlife, or human use) by WDNR
WDB6	65	Stream3	waters (ft) within the composite wetland mapped as "Type 3" (slight to moderate fish, wildlife, or human use) by WDNR
WDB6	66	Stream4	waters (ft) within the composite wetland mapped as "Type 4" (perennial streams without fish) by WDNR
WDB6	67	Stream5	waters (ft) within the composite wetland mapped as "Type 5" (intermittent streams & other aquatic habitat) by WDNR
WDB6	68	SideChanFtDNR	waters (ft) within the composite wetland mapped as "side channels" by WDNR
WDB6	69	LakeFtDNR	waters (ft) within the composite wetland mapped as "lakes/ ponds" by WDNR
WDB6	70	NHPpctAllMax	% of wetland mapped as habitat for a feature recognized by DNR's Washington Natural Heritage Program; maximum was used
WDB6	71	NHPpctWetMax	% of wetland mapped as a recognized wetland habitat by DNR's Washington Natural Heritage Program
WDB6	72	BogStatus	1= wetland is at least partially a bog based on 2005 data; 2= bog conditions only inferred from airphotos, or 2005 site visit indicated only minimal bog conditions persist; 3= bog conditions documented historically but no recent data
WDB6	73	Riparian	1= part of the wetland is mapped as an important Riparian habitat by the WDNR Natural Heritage Program
WDB6	74	MatureFor	1= part of the wetland is mapped as Mature Forest habitat by the WDNR Natural Heritage Program
WDB6	75	UrbanNatOpenSp	1= part of the wetland is mapped as Urban Natural Open Space by the WDNR Natural Heritage Program
WDB6	76	BaldEagle	1= part of the wetland is mapped as an important Bald Eagle habitat by the WDNR Natural Heritage Program
WDB6	77	WoodDuck	1= part of the wetland is mapped as an important Wood Duck habitat by the WDNR Natural Heritage Program

WDB6	78	BTpigeon	1= part of the wetland is mapped as an important habitat for Band-tailed Pigeon by the WDNR Natural Heritage Program
WDB6	79	HarlequinD	1= part of the wetland is mapped as an important habitat for Harlequin Duck by the WDNR Natural Heritage Program
WDB6	80	CavNestDucks	1= part of the wetland is mapped as an important habitat for Cavity-nesting Ducks by the WDNR Natural Heritage Program
WDB6	81	WfowlConc	1= part of the wetland is mapped as an important Waterfowl Concentration area by the WDNR Natural Heritage Program
WDB6	82	ShorebConc	1= part of the wetland is mapped as an important Shorebird Concentration area by the WDNR Natural Heritage Program
WDB6	83	SeabirdConc	1= part of the wetland is mapped as an important Seabird Concentration area by the WDNR Natural Heritage Program
WDB6	84	NWIdomCode	NWI map code for the NWI polygon comprising the largest proportion of the composite wetland's area
WDB6	85	NWInumCodes	number of uniquely-coded NWI polygons within the composite wetland's area
WDB6	86	NWIowPct	percent of the NWI-mapped part of the wetland that is open water (coded US or UB) according to NWI
WDB6	87	NWInumClasses	number of Cowardin vegetation classes mapped by NWI within the polygon; only available for polygons with some NWI overlap (0= polygon contains no mappable wetland vegetation -- open water only)
WDB6	88	NWInumHypds	number of different hydroperiods in the NWI-mapped portion of the wetland
WDB6	89	EstuNWI	at least one polygon mapped as Estuarine is present within the composite wetland polygon
WDB6	90	PalusNWI	at least one polygon mapped as Palustrine by NWI is present within the composite wetland polygon
WDB6	91	LacusNWI	at least one polygon mapped as Lacustrine is by NWI present within the composite wetland polygon
WDB6	92	Em_NWI	at least one polygon mapped as Emergent by NWI present within the composite wetland polygon
WDB6	93	AB_NWI	at least one polygon mapped by NWI as Aquatic Bed is present within the composite wetland polygon
WDB6	94	SS_NWI	at least one polygon mapped by NWI as Scrub-shrub is present within the composite wetland polygon
WDB6	95	FO_NWI	at least one polygon mapped by NWI as Forested is present within the composite wetland polygon
WDB6	96	US_NWI	at least one polygon mapped by NWI as Unconsolidated Shore (mainly open water) is present within the composite wetland polygon
WDB6	97	UB_NWI	at least one polygon mapped by NWI as Unconsolidated Bottom (mainly open water) is present within the composite wetland polygon
WDB6	98	TempF_NWI	at least one polygon mapped by NWI as Temporarily Flooded is present within the composite wetland polygon
WDB6	99	Satur_NWI	at least one polygon mapped by NWI as Saturated is present within the composite wetland polygon
WDB6	100	SeasF_NWI	at least one polygon mapped by NWI as Seasonally Flooded is present within the composite wetland polygon
WDB6	101	SeasF2_NWI	at least one polygon mapped by NWI as Seasonally Flooded/ well-drained is present within the composite wetland polygon
WDB6	102	SeasF3_NWI	at least one polygon mapped by NWI as Seasonally Flooded/ saturated is present within the composite wetland polygon

WDB6	103	SemiF_NWI	at least one polygon mapped by NWI as Semipermanently Flooded is present within the composite wetland polygon
WDB6	104	IntExp_NWI	at least one polygon mapped by NWI as Intermittently Exposed is present within the composite wetland polygon
WDB6	105	PermF_NWI	at least one polygon mapped by NWI as Permanently Flooded is present within the composite wetland polygon
WDB6	106	PermF2_NWI	at least one polygon mapped by NWI as Permanently Flooded - tidal is present within the composite wetland polygon
WDB6	107	Subtidal_NWI	at least one polygon mapped by NWI as Irregularly Exposed is present within the composite wetland polygon
WDB6	108	Intertidal_NWI	at least one polygon mapped by NWI as Regularly Flooded is present within the composite wetland polygon
WDB6	109	Supratidal_NWI	at least one polygon mapped by NWI as Irregularly Flooded is present within the composite wetland polygon
WDB6	110	SeasTidal_NWI	at least one polygon mapped by NWI as Tidal- Seasonal is present within the composite wetland polygon
WDB6	111	TempTidal_NWI	at least one polygon mapped by NWI as Tidal-Temporary is present within the composite wetland polygon
WDB6	112	SemipTidal_NWI	at least one polygon mapped by NWI as Tidal-Semipermanent is present within the composite wetland polygon
WDB6	113	Beaver_NWI	at least one polygon mapped by NWI as Beaver-impounded is present within the composite wetland polygon
WDB6	114	ShedSalmo	1= wetland is within a watershed (basin) known to support salmon
WDB6	115	ShedPockEstu	1= wetland is within a watershed (basin) known to empty into a pocket estuary
WDB6	116	PolyJoin1	identifier (ID05 code) of old wetland polygon that was joined with the current one (ID06)
WDB6	117	PolyJoin2	identifier (ID05 code) of old wetland polygon that was joined with the current one (ID06)
WDB6	118	PolyJoin3	identifier (ID05 code) of old wetland polygon that was joined with the current one (ID06)
WDB6	119	WQeffect	WDOE Rating System score for effectiveness (potential capacity) of the wetland to purify incoming water; higher score = greater function; available only for visited wetlands
WDB6	120	HydEffect	WDOE Rating System score for effectiveness (potential capacity) of the wetland to temporarily store or delay water; higher score = greater function; available only for visited wetlands
WDB6	121	HabEffect	WDOE Rating System score for effectiveness (potential capacity) of the wetland to provide habitat; higher score = greater function; available only for visited wetlands
WDB6	122	ScoreEffect	sum of the above 3
WDB6	123	WQ_WDOE	WDOE Rating System total score for the water purification function; higher score = more pollution inputs and/or greater ability of the wetland to treat it; available only for visited wetlands
WDB6	124	HydWDOE	WDOE Rating System total score for the water storage and delay function; higher score = more incoming water and/or greater ability to store it; available only for visited wetlands
WDB6	125	HabWDOE	WDOE Rating System score for effectiveness (potential capacity) of the wetland to provide habitat; higher score = greater function; available only for visited wetlands
WDB6	126	ScoreWDOE	sum of the above 3

WDB6	127	Cat_DOE	Category assigned by the WDOE Rating System, based both on ScoreWDOE and Special Characteristics from the WDOE list
WDB6	128	Cat_IC	Category assigned by Island County's original categorization system: A (most protective), B, or C (least protective). Lower-case letters indicate the categorization was not field checked so is probably unreliable. Where multiple parcels are present within a wetland and they have diverse categories, the category assigned to the most parcels was assigned to the whole wetland in this database.
WDB6	129	TreeSSpctIC	percent cover of trees and shrubs for the whole wetland as estimated during 2005 site visit
WDB6	130	EmPctIC	percent cover of emergent (herbaceous) vegetation for the whole wetland as estimated during 2005 site visit
WDB6	131	ABpctIC	percent cover of aquatic bed vegetation for the whole wetland as estimated during 2005 site visit
WDB6	132	MossPctIC	percent cover of moss for the whole wetland as estimated during 2005 site visit
WDB6	133	WatPermPctIC	percent cover of permanent water for the whole wetland as estimated during 2005 site visit
WDB6	134	BarePctIC	percent cover of bare mud, sand, rock, dirt for the whole wetland as estimated during 2005 site visit
WDB6	135	IndicChanHt	height (inches) of high water indicator found along the wetland's channel during 2005
WDB6	136	IndicStandHt	height (inches) of high water indicator found along the wetland's standing water area during 2005
WDB6	137	DepthWetStand	estimated maximum depth of standing surface water during wettest 2 weeks annually
WDB6	138	DepthWetFlow	estimated maximum depth of flowing surface water during wettest 2 weeks annually
WDB6	139	DepthDryStand	estimated maximum depth of standing surface water during driest 2 weeks annually
WDB6	140	DepthDryFlow	estimated maximum depth of flowing surface water during driest 2 weeks annually
WDB6	141	HypdTempPctIC	% of the wetland estimated to be inundated continuously for only 2-4 weeks/ year
WDB6	142	HypdSeasPctIC	% of the wetland estimated to be inundated for longer but not continuously year-round
WDB6	143	HypdPermPctIC	% of the wetland estimated to be inundated year-round without interruption
WDB6	144	HypdSatPctIC	% of the wetland estimated to almost never be inundated, but soil is saturated for >2 weeks/year
WDB6	145	Tide_dayPact	% of the wetland estimated to be inundated daily by tides
WDB6	146	Tide_annualPct	% of the wetland estimated to be inundated at least once annually by tides
WDB6	147	Tide_ponded	% of the wetland estimated to be inundated by ponding of tidal waters
WDB6	148	ShadedOW	% of the wetland's open water estimated to be shaded by vegetation or topography during summer mid-day
WDB6	149	Conduc	specific conductance measured during 2005 visit
WDB6	150	TURTLE	1= turtle observed by or reported to the field crew in 2005; 0= offsite but nearby
WDB6	151	TOAD	1= toads observed by or reported to the field crew in 2005; 0= offsite but nearby

WDB6	152	FROG	1= frog observed by or reported to the field crew in 2005; 0= offsite but nearby
WDB6	153	SALA	1= salamander or newt observed by or reported to the field crew in 2005; 0= offsite but nearby
WDB6	154	SALMO	1= salmon observed by or reported to the field crew in 2005; 0= offsite but nearby
WDB6	155	DFLY	1= dragonfly observed by or reported to the field crew in 2005; 0= offsite but nearby
WDB6	156	BTPI	1= band-tailed pigeon observed by or reported to the field crew in 2005; 0= offsite but nearby
WDB6	157	DUCKS	1= ducks or geese observed by or reported to the field crew in 2005; 0= offsite but nearby
WDB6	158	SBIRD	1= sandpipers/ killdeer observed by or reported to the field crew in 2005; 0= offsite but nearby
WDB6	159	EAGLE	1= bald eagle observed by or reported to the field crew in 2005; 0= offsite but nearby
WDB6	160	HAWK	1= hawk observed by or reported to the field crew in 2005; 0= offsite but nearby
WDB6	161	OSPREY	1= osprey observed by or reported to the field crew in 2005; 0= offsite but nearby
WDB6	162	OWL	1= owl observed by or reported to the field crew in 2005; 0= offsite but nearby
WDB6	163	HERON	1= heron observed by or reported to the field crew in 2005; 0= offsite but nearby
WDB6	164	PIWO	1= pileated woodpecker observed by or reported to the field crew in 2005; 0= offsite but nearby
WDB6	165	BEAVER	1= beaver observed by or reported to the field crew in 2005; 0= offsite but nearby
WDB6	166	MUSKRAT	1= muskrat observed by or reported to the field crew in 2005; 0= offsite but nearby
WDB6	167	CA_SoilDom	the NRCS map code (musym) for the most prevalent soil type in the non-estuarine wetland's contributing area
WDB6	168	CA_SlopeDom	the slope category of the most prevalent soil type in the non-estuarine wetland's contributing area as mapped by NRCS
WDB6	169	CA_SlopeMax	the maximum slope of the non-estuarine wetland's contributing area as estimated by the DEM
WDB6	170	CA_SlopeAvg	the average slope of the non-estuarine wetland's contributing area as estimated by the DEM
WDB6	171	CA_ElevMax	the maximum elevation (ft) of the non-estuarine wetland's contributing area as estimated by the DEM
WDB6	172	CA_ElevAvg	the average elevation (ft) of the non-estuarine wetland's contributing area as estimated by the DEM
WDB6	173	CA_precip	the estimated mean annual precipitation (inches) in the non-estuarine wetland's contributing area; from modeled data
WDB6	174	CA_HydDNRpct	% of the non-estuarine contributing area that was mapped by DNR as hydric soil
WDB6	175	CA_HydNRCSpct	% of the non-estuarine contributing area that was mapped by NRCS as hydric soil
WDB6	176	CA_gwHiPct	% of the non-estuarine contributing area that coincides with an area mapped as a High Susceptibility Aquifer

WDB6	177	CA_gwMedPct	% of the non-estuarine contributing area that coincides with an area mapped as a Moderate Susceptibility Aquifer
WDB6	178	CA_gwLoPct	% of the non-estuarine contributing area that coincides with an area mapped as a Low Susceptibility Aquifer
WDB6	179	CA_str1ft	waters (ft) within the non-estuarine contributing area mapped as "Type 1" (shorelines) by WDNR
WDB6	180	CA_str3ft	waters (ft) within the non-estuarine contributing area mapped as "Type 3" (slight to moderate fish, wildlife, or human use) by WDNR
WDB6	181	CA_str4ft	waters (ft) within the non-estuarine contributing area mapped as "Type 4" (perennial streams without fish) by WDNR
WDB6	182	CA_str5ft	waters (ft) within the non-estuarine contributing area mapped as "Type 5" (intermittent streams & other aquatic habitat) by WDNR
WDB6	183	CA_strFtSum	total stream ft within the non-estuarine contributing area as mapped by WDNR
DDB6	1	ID06	numerical identifier for composite wetland polygon, assigned in 2006
DDB6	2	ID05	numerical identifier for composite wetland polygon, assigned in 2005
DDB6	3	PointID	numerical identifier for sample point within the polygon (1= highest priority sample point/ polygon). Called SiteID in some files.
DDB6	4	Visited	1= field data collected in 2005.
DDB6	5	AcresPoly	acreage of the composite wetland polygon
DDB6	6	LC98domTyp	numerical class code for the dominant land cover class within the wetland polygon based on 1998 satellite imagery
DDB6	7	LC92domTyp	numerical class code for the dominant land cover class within the wetland polygon based on 1992 satellite imagery
DDB6	8	LC98name	name of the dominant land cover class within the wetland polygon based on 1998 satellite imagery
DDB6	9	LC92name	name of the domininant land cover class within the wetland polygon based on 1992 satellite imagery
DDB6	10	ZoneDom	name of the dominant zoning category within the wetland polygon
DDB6	11	ShedID	numerical identifier for the associated watershed (basin)
DDB6	12	ShedRisk	risk score for the associated watershed (see Adamus et al. 2006 for details of calculation)
DDB6	13	ShedAgPct	percent of the associated watershed that is zoned for agriculture (see Adamus et al. 2006 for details of calculation)
DDB6	14	ShedDevPct	percent of the associated watershed that is developed (see Adamus et al. 2006 for details of calculation)
DDB6	15	ShedRdDens	feet of road per acre (x 100) in the associated watershed
DDB6	16	ShedFyPct	percent of the associated watershed that has had recent (1996-2004) DNR-regulated timber harvests
DDB6	17	ArtifF_NWI	1= wetland hydroperiod is "artificially flooded" according to NWI interpretation of 1970s airphotos
DDB6	18	NWIdiked	1= wetland is classified as "diked" according to NWI interpretation of 1970s airphotos
DDB6	19	NWIexcav	1= wetland is classified as "excavated" according to NWI interpretation of 1970s airphotos
DDB6	20	NWIditch	1= wetland is classified as "ditched" according to NWI interpretation of 1970s airphotos
DDB6	21	DitchFt	feet of ditches within the wetland polygon according to the DNR streams database

DDB6	22	MadeLandPct	percent of the wetland polygon with soils classified by NRCS as "made land" i.e., generally "fill"
DDB6	23	NonHydricDNR	percent of the wetland polygon with soils classified by DNR as non-hydric
DDB6	24	NonHydric1NRCS	percent of the wetland polygon with soils classified by NRCS as non-hydric
DDB6	25	NonHydric2NRCS	percent of the wetland polygon with soils classified by NRCS as neither hydric nor as potentially having hydric inclusions
DDB6	26	GWsamp	number of ground water (well) samples within 100 ft of the wetland polygon that have been analyzed by ICHD
DDB6	27	SWsamp	number of surface water samples within 100 ft of the wetland polygon
DDB6	28	RdFtSum	feet of roads of all types within the wetland polygon
DDB6	29	RdFt0	feet of roads of type "0" within the wetland polygon
DDB6	30	RdFt1	feet of roads of type "1" within the wetland polygon
DDB6	31	RdFt2	feet of roads of type "2" within the wetland polygon
DDB6	32	RdFt3	feet of roads of type "3" within the wetland polygon
DDB6	33	RdFt11	feet of roads of type "11" within the wetland polygon
DDB6	34	RdFt14	feet of roads of type "14" within the wetland polygon
DDB6	35	FyOpsAc	acreage within the wetland polygon that has had recent (1996-2004) DNR-regulated timber harvests
DDB6	36	FyOpsPct	percent of the wetland polygon that has had recent (1996-2004) DNR-regulated timber harvests
DDB6	37	ParkAc	acreage of the wetland polygon with a zoning category of "park" according to IDPCD
DDB6	38	FedLandAc	acreage of the wetland polygon with a zoning category of "federal land" according to IDPCD
DDB6	39	RuralAc	acreage of the wetland polygon with a zoning category of "rural" according to IDPCD
DDB6	40	RuralAgAc	acreage of the wetland polygon with a zoning category of "rural agriculture" according to IDPCD
DDB6	41	MunicAc	acreage of the wetland polygon with a zoning category of "municipality" according to IDPCD
DDB6	42	RuralResAc	acreage of the wetland polygon with a zoning category of "rural residential" according to IDPCD
DDB6	43	RuralVillAc	acreage of the wetland polygon with a zoning category of "rural village" according to IDPCD
DDB6	44	RuralForestAc	acreage of the wetland polygon with a zoning category of "rural forest" according to IDPCD
DDB6	45	CommAgAc	acreage of the wetland polygon with a zoning category of "commercial agriculture" according to IDPCD
DDB6	46	RuralCtrAc	acreage of the wetland polygon with a zoning category of "rural center" according to IDPCD
DDB6	47	LightMfgAc	acreage of the wetland polygon with a zoning category of "light manufacturing" according to IDPCD
DDB6	48	AirportAc	acreage of the wetland polygon with a zoning category of "airport" according to IDPCD
DDB6	49	RevuDistAc	acreage of the wetland polygon with a zoning category of "review district" according to IDPCD
DDB6	50	RuralServAc	acreage of the wetland polygon with a zoning category of "rural service district" according to IDPCD

DDB6	51	CDAac	acreage of the wetland polygon classified as "Critical Drainage Area" by ICDPW
DDB6	52	ParkPct	proportion of the wetland polygon with a zoning category of "park" according to IDPCD
DDB6	53	FedLandPct	proportion of the wetland polygon with a zoning category of "federal land" according to IDPCD
DDB6	54	RuralPct	proportion of the wetland polygon with a zoning category of "rural" according to IDPCD
DDB6	55	RuralAgPct	proportion of the wetland polygon with a zoning category of "rural agriculture" according to IDPCD
DDB6	56	MunicPct	proportion of the wetland polygon with a zoning category of "municipality" according to IDPCD
DDB6	57	RuralResPct	proportion of the wetland polygon with a zoning category of "rural residential" according to IDPCD
DDB6	58	RuralVillPct	proportion of the wetland polygon with a zoning category of "rural village" according to IDPCD
DDB6	59	RuralForestPct	proportion of the wetland polygon with a zoning category of "rural forest" according to IDPCD
DDB6	60	CommAgPct	proportion of the wetland polygon with a zoning category of "commercial agriculture" according to IDPCD
DDB6	61	RuralCtrPct	proportion of the wetland polygon with a zoning category of "rural center" according to IDPCD
DDB6	62	LightMfgPct	proportion of the wetland polygon with a zoning category of "light manufacturing" according to IDPCD
DDB6	63	AirportPct	proportion of the wetland polygon with a zoning category of "airport" according to IDPCD
DDB6	64	RevuDistPct	proportion of the wetland polygon with a zoning category of "review district" according to IDPCD
DDB6	65	RuralServPct	proportion of the wetland polygon with a zoning category of "rural service district" according to IDPCD
DDB6	66	CDAPct	proportion of the wetland polygon classified as "Critical Drainage Area" by ICDPW
DDB6	67	ChlorideAvg	mean chloride concentration (mg/L) in wells sampled within 100 ft of the wetland by ICPH
DDB6	68	NO3Avg	mean nitrate concentration (mg/L) in wells sampled within 100 ft of the wetland by ICPH
DDB6	69	ChlorideMax	maximum chloride concentration (mg/L) in wells sampled within 100 ft of the wetland by ICPH
DDB6	70	NO3Max	maximum nitrate concentration (mg/L) in wells sampled within 100 ft of the wetland by ICPH
DDB6	71	DevelHiDen	percent of wetland containing land cover class 1 (1998 satellite imagery)
DDB6	72	DevelLoDen	percent of wetland containing land cover class 2 (1998 satellite imagery)
DDB6	73	Mowed	percent of wetland containing land cover class 3 (1998 satellite imagery)
DDB6	74	GrassSparse	percent of wetland containing land cover class 4 (1998 satellite imagery)
DDB6	75	ForestDecid	percent of wetland containing land cover class 5 (1998 satellite imagery)
DDB6	76	ForestEverg	percent of wetland containing land cover class 6 (1998 satellite imagery)
DDB6	77	ForestMix	percent of wetland containing land cover class 7 (1998 satellite imagery)
DDB6	78	ShrubAgMix	percent of wetland containing land cover class 8 (1998 satellite imagery)
DDB6	79	WetForest	percent of wetland containing land cover class 9 (1998 satellite imagery)
DDB6	80	WetShrub	percent of wetland containing land cover class 10 (1998 satellite imagery)
DDB6	81	WetEmNonEst	percent of wetland containing land cover class 11 (1998 satellite imagery)

DDB6	82	WetEmEst	percent of wetland containing land cover class 12 (1998 satellite imagery)
DDB6	83	OWshallow	percent of wetland containing land cover class 13 (1998 satellite imagery)
DDB6	84	OpenWater	percent of wetland containing land cover class 15 (1998 satellite imagery)
DDB6	85	Bare	percent of wetland containing land cover class 14 (1998 satellite imagery)
DDB6	86	WetEmForest	percent of wetland containing land cover class 16 (1998 satellite imagery)
DDB6	87	ShrubGrass	percent of wetland containing land cover class 17 (1998 satellite imagery)
DDB6	88	RuralLawn	percent of wetland containing land cover class 18 (1998 satellite imagery)
DDB6	89	RiparVeg	percent of wetland containing land cover class 19 (1998 satellite imagery)
DDB6	90	WetEmSS	percent of wetland containing land cover class 20 (1998 satellite imagery)
DDB6	91	ForestOpenSS	percent of wetland containing land cover class 21 (1998 satellite imagery)
DDB6	92	DevelLoDenSS	percent of wetland containing land cover class 22 (1998 satellite imagery)
DDB6	93	GrassUrban	percent of wetland containing land cover class 25 (1998 satellite imagery)
DDB6	94	ShrubUrban	percent of wetland containing land cover class 26 (1998 satellite imagery)
DDB6	95	ShrubForest	percent of wetland containing land cover class 27 (1998 satellite imagery)
DDB6	96	GrassShort	percent of wetland containing land cover class 28 (1998 satellite imagery)
DDB6	97	ForestEvgrOpen	percent of wetland containing land cover class 29 (1998 satellite imagery)
DDB6	98	ForestSSgrass	percent of wetland containing land cover class 30 (1998 satellite imagery)
DDB6	99	ShrubEvgr	percent of wetland containing land cover class 31 (1998 satellite imagery)
DDB6	100	ShrubDecid	percent of wetland containing land cover class 32 (1998 satellite imagery)
DDB6	101	DevelLoDenGrass	percent of wetland containing land cover class 36 (1998 satellite imagery)
DDB6	102	Burn	field observation of past or present burn within the wetland; scored as follows: Ongoing / Recent Past / Distant Past <1% of wetland: 7 / 5 / 1 10-50%: 8 / 6 / 2 11-10%: 11 / 9 / 3 >50%: 12 / 10 / 4
DDB6	103	Chaniz	field observation of past or present channel bank reconfiguration within the wetland; see above table for scoring
DDB6	104	Ditch	field observation of past or present ditching within the wetland; see above table for scoring
DDB6	105	Excav	field observation of past or present excavation within the wetland; see above table for scoring
DDB6	106	Fence	field observation of fence within the wetland; see above table for scoring
DDB6	107	Spray	field observation of past or present fertilizer or pesticide application within the wetland; see above table for scoring
DDB6	108	Graz	field observation of past or present grazing within the wetland; see above table for scoring
DDB6	109	Drain	field observation of past or present subsurface drainage pipes within the wetland; see above table for scoring
DDB6	110	Mow	field observation of past or present mowing within the wetland; see above table for scoring
DDB6	111	DamWC	field observation of a dam within the wetland with a water control structure; see above table for scoring
DDB6	112	DamNoWC	field observation of a dam within the wetland without a water control structure; see above table for scoring
DDB6	113	Dike	field observation of past or present dike, levee, or lateral berm within the wetland; see above table for scoring
DDB6	114	Crops	field observation of past or present crop planting or garden within the wetland; see above table for scoring
DDB6	115	Hort	field observation of past or present planting of horticultural shrubs within the wetland; see above table for scoring
DDB6	116	Refor	field observation of past or present reforestation within the wetland; see above

			table for scoring
DDB6	117	LawnPast	field observation of past or present lawn or pasture within the wetland; see above table for scoring
DDB6	118	PlantOth	field observation of past or present planting of other vegetation within the wetland; see above table for scoring
DDB6	119	FillGrade	field observation of past or present filling or grading within the wetland; see above table for scoring
DDB6	120	Riprap	field observation of past or present riprapping within the wetland ; see above table for scoring
DDB6	121	Road	field observation of past or present road or driveway within the wetland; see above table for scoring
DDB6	122	SedBarr	field observation of logs or hay bales placed within the wetland to control erosion; see above table for scoring
DDB6	123	Tillage	field observation of past or present tillage of soils within the wetland; see above table for scoring
DDB6	124	Stormw	field observation of past or present stormwater ditch or pipe entering the wetland; see above table for scoring
DDB6	125	Trail	field observation of past or present trail constructed within the wetland; see above table for scoring
DDB6	126	TrashP	field observation of past or present trash pile within the wetland; see above table for scoring
DDB6	127	Logged	field observation of past or present logging within the wetland; see above table for scoring
DDB6	128	LogOthr	field observation of past or present tree thinning within the wetland; see above table for scoring
DDB6	129	ROWcut	field observation of past or present utility clearing within the wetland; see above table for scoring
DDB6	130	VehTrax	field observation of vehicle tracks within the wetland; see above table for scoring
DDB6	131	WatrRemov	field observation of water removal within the wetland for irrigation use; see above table for scoring
DDB6	132	Downcut	1= unnaturally incised (entrenched) channel was noted during field visit
DDB6	133	Algae	1= massive growth of aquatic algae was noted during field visit
DDB6	134	WatColor	1= unnatural water or sediment color was noted during field visit
DDB6	135	SedDepos	1= major sediment coatings of wetland vegetation was noted during field visit
DDB6	136	NnEMpc	percent of emergent plant cover that is comprised of non-native species
DDB6	137	NnABpc	percent of aquatic bed plant cover that is comprised of non-native species
DDB6	138	NnSSFOpc	percent of shrub cover that is comprised of non-native species
DDB6	139	ImpervEdgePct	percent of the wetland-upland edge that contains impervious surface, e.g., road
DDB6	140	BareEdgePct	percent of the wetland-upland edge that contains other bare surfaces, e.g., dunes
DDB6	141	WoodyEdgePct	percent of the wetland-upland edge that contains trees or shrubs
DDB6	142	PastureEdgePct	percent of the wetland-upland edge that contains uncultivated grasses & forbs, e.g., pasture
DDB6	143	LawnEdgePct	percent of the wetland-upland edge that contains cultivated grasses & forbs, e.g., lawn
DDB6	144	WaterEdgePct	percent of the wetland-upland edge that contains impervious surface, e.g., road
DDB6	145	DistPermRes	distance (ft) to the nearest year-round residence; if distance >2000 ft, then left blank

DDB6	146	DistSeasRes	distance (ft) to the nearest seasonal or residence; if distance >2000 ft, then left blank
DDB6	147	DistSchool	distance (ft) to the nearest school or church; if distance >2000 ft, then left blank
DDB6	148	DistComm	distance (ft) to the nearest commercial, industrial, or office facility; if distance >2000 ft, then left blank
DDB6	149	DistBarn	distance (ft) to the nearest barn or shed; if distance >2000 ft, then left blank
DDB6	150	DistOthStruc	distance (ft) to the nearest year-round residence; if distance >2000 ft, then left blank
DDB6	151	Air_Li	LiDAR image shows an airstrip in part of the wetland polygon in 2001
DDB6	152	Bdg_Li	LiDAR image shows a building in part of the wetland polygon in 2001
DDB6	153	Berm_Li	LiDAR image shows a berm in part of the wetland polygon in 2001 (some may be drainfields)
DDB6	154	Clearg_Li	LiDAR image and/or 1998 aerial photograph shows cleared vegetation in part of the wetland polygon in 2001
DDB6	155	Field_Li	LiDAR image and/or 1998 aerial photograph shows a field in part of the wetland polygon in 2001
DDB6	156	Ditch_Li	LiDAR image shows ditching in part of the wetland polygon in 2001
DDB6	157	Fence_Li	LiDAR image shows a fence in part of the wetland polygon in 2001
DDB6	158	Fill_Li	LiDAR image shows fill placed in part of the wetland polygon in 2001
DDB6	159	Gradg_Li	LiDAR image shows grading of the soil in part of the wetland polygon in 2001
DDB6	160	Pit_Li	LiDAR image shows a gravel pit (may be ponded) in part of the wetland polygon in 2001
DDB6	161	Trail_Li	LiDAR image shows a trail in part of the wetland polygon in 2001
DDB6	162	Drwy_Li	LiDAR image shows a driveway in part of the wetland polygon in 2001
DDB6	163	GRd_Li	LiDAR image shows a gravel road in part of the wetland polygon in 2001
DDB6	164	PRd_Li	LiDAR image shows a paved road in part of the wetland polygon in 2001
DDB6	165	Rd_Li	LiDAR image shows a road (type unknown) in part of the wetland polygon in 2001
DDB6	166	PkgLot_Li	LiDAR image shows a parking lot in part of the wetland polygon in 2001
DDB6	167	Pond_Li	LiDAR image shows an artificial (probably) pond in part of the wetland polygon in 2001
DDB6	168	Excav_Li	LiDAR image shows an excavated area in part of the wetland polygon in 2001
DDB6	169	Pond?	P= pond occupies >40% of the composite wetland polygon
DDB6	170	PondPct	percent of wetland occupied by an artificial pond
DDB6	171	GeoAltExtent	estimated relative extent of geomorphic alteration of the wetland based on LiDAR Scored 0 (none) to 1.00 (most)
DDB6	172	LinearAlt	estimated relative extent of artificial linear features within the wetland based on LiDAR Scored 0 (none) to 5 (most)
DDB6	173	VegAlt	estimated relative extent of vegetation alteration of the wetland based on LiDAR and 1998 airphoto. Scored 0 (none) to 1.00 (most)
DDB6	174	Dscore	estimated relative overall extent of geomorphic & linear alteration of the wetland based on LiDAR and 1998 airphoto. Scored 0 (none) to 10 (most)
DDB6	175	DscoreVegIncl	estimated relative overall extent of geomorphic & linear alteration & vegetation disturbance of the wetland based on LiDAR and 1998 airphoto. Scored 0 (none) to 10 (most)
DDB6	176	PctNatur	percent of the wetland estimated from LiDAR and 1998 airphoto to be in relatively natural condition. Not estimated for all images examined.

DDB6	177	NewChange	alteration apparently occurred between 1998 (airphoto) and 2001 (LiDAR image)
DDB6	178	CA_madelandPct	percent of the non-estuarine wetland's contributing area having soils classified by NRCS as "made land" i.e., generally "fill"
DDB6	179	CA_CDApct	percent of the non-estuarine contributing area classified as "Critical Drainage Area" by ICDPW
DDB6	180	CA_roadft	linear feet of roads within the non-estuarine wetland's contributing area
DDB6	181	CA_rddens	density of roads (ft per acre) within the non-estuarine wetland's contributing area
DDB6	182	CA_rd1ft	feet of roads of type "1" within the non-estuarine wetland contributing area
DDB6	183	CA_rd2ft	feet of roads of type "2" within the non-estuarine wetland contributing area
DDB6	184	CA_rd3ft	feet of roads of type "3" within the non-estuarine wetland contributing area
DDB6	185	CA_rd11ft	feet of roads of type "11" within the non-estuarine wetland contributing area
DDB6	186	CA_rd14ft	feet of roads of type "14" within the non-estuarine wetland contributing area
DDB6	187	CA_rd0ft	feet of roads of type "0" within the non-estuarine wetland contributing area
DDB6	188	CA_rd10ft	feet of roads of type "10" within the non-estuarine wetland contributing area
DDB6	189	CA_rd13ft	feet of roads of type "13" within the non-estuarine wetland contributing area
DDB6	190	CA_fy_EvenPct	percent of the non-estuarine contributing area that has had recent (1996-2004) DNR-regulated timber harvests (even-age cut)
DDB6	191	CA_fy_UnevenPct	percent of the non-estuarine contributing area that has had recent (1996-2004) DNR-regulated timber harvests (uneven-age cut)
DDB6	192	CA_fy_ROWpct	percent of the non-estuarine contributing area that has had recent (1996-2004) DNR-regulated timber harvests (right-of-way cut)
DDB6	193	CA_fy_SalvgPct	percent of the non-estuarine contributing area that has had recent (1996-2004) DNR-regulated timber harvests (salvage cut)
DDB6	194	CA_fy_Total	percent of the non-estuarine contributing area that has had recent (1996-2004) DNR-regulated timber harvests (all types summed)
DDB6	195	CA_LC98dom	name of the non-estuarine dominant land cover class within the contributing area based on 1998 satellite imagery
DDB6	196	CA_LC98pctDom	percent of the contributing area comprised by the above land cover class
DDB6	197	CA_1LC98	percent of the non-estuarine contributing area containing land cover class 1 (1998 satellite imagery): Developed High Density
DDB6	198	CA_2LC98	percent of contributing area containing land cover class 2 (1998 satellite imagery): Developed Low Density
DDB6	199	CA_3lc98	percent of contributing area containing land cover class 3 (1998 satellite imagery): Mowed
DDB6	200	CA_4lc98	percent of contributing area containing land cover class 4 (1998 satellite imagery): Grass Sparse
DDB6	201	CA_5lc98	percent of contributing area containing land cover class 5 (1998 satellite imagery): Forest Deciduous
DDB6	202	CA_6lc98	percent of contributing area containing land cover class 6 (1998 satellite imagery): Forest Evergreen
DDB6	203	CA_7lc98	percent of contributing area containing land cover class 7 (1998 satellite imagery): Forest Mixed
DDB6	204	CA_8lc98	percent of contributing area containing land cover class 8 (1998 satellite imagery): Shrub-Ag Mixed
DDB6	205	CA_9lc98	percent of contributing area containing land cover class 9 (1998 satellite imagery): Forested Wetland
DDB6	206	CA_10lc98	percent of contributing area containing land cover class 10 (1998 satellite imagery): Shrub Wetland

DDB6	207	CA_11lc98	percent of contributing area containing land cover class 11 (1998 satellite imagery): Emergent Non-estuarine Wetland
DDB6	208	CA_13lc98	percent of contributing area containing land cover class 13 (1998 satellite imagery): Shallow Open Water
DDB6	209	CA_14lc98	percent of contributing area containing land cover class 15 (1998 satellite imagery): Open Water
DDB6	210	CA_15lc98	percent of contributing area containing land cover class 14 (1998 satellite imagery): Bare
DDB6	211	CA_16lc98	percent of contributing area containing land cover class 16 (1998 satellite imagery): Deciduous Forest Marsh
DDB6	212	CA_17lc98	percent of contributing area containing land cover class 17 (1998 satellite imagery): Shrub-grass including clearcuts
DDB6	213	CA_18lc98	percent of contributing area containing land cover class 18 (1998 satellite imagery): Rural Lawn
DDB6	214	CA_19lc98	percent of contributing area containing land cover class 19 (1998 satellite imagery): Shoreline Vegetation
DDB6	215	CA_20lc98	percent of contributing area containing land cover class 20 (1998 satellite imagery): Marsh with Scattered Shrub
DDB6	216	CA_21LC98	percent of contributing area containing land cover class 21 (1998 satellite imagery): Forest Open Marsh
DDB6	217	CA_22lc98	percent of contributing area containing land cover class 22 (1998 satellite imagery): Developed Low Density with Shrubs
DDB6	218	CA_25lc98	percent of contributing area containing land cover class 25 (1998 satellite imagery): Urban Grass
DDB6	219	CA_26lc98	percent of contributing area containing land cover class 26 (1998 satellite imagery): Urban Shrub
DDB6	220	CA_27lc98	percent of contributing area containing land cover class 27 (1998 satellite imagery): Deciduous Shrub Forest
DDB6	221	CA_28lc98	percent of contributing area containing land cover class 28 (1998 satellite imagery): Short Grass
DDB6	222	CA_29lc98	percent of contributing area containing land cover class 29 (1998 satellite imagery): Evergreen Forest with Open Canopy
DDB6	223	CA_30lc98	percent of contributing area containing land cover class 30 (1998 satellite imagery): Open Forest with Shrubs
DDB6	224	CA_31lc98	percent of contributing area containing land cover class 31 (1998 satellite imagery): Shrubs and Grass
DDB6	225	CA_32lc98	percent of contributing area containing land cover class 32 (1998 satellite imagery): Mixed Deciduous Shrubs
DDB6	226	CA_36lc98	percent of contributing area containing land cover class 36 (1998 satellite imagery): Developed Low Density with Bare & Grass
DDB6	227	CA_ZoneDomPct	name of the dominant zoning category within the wetland contributing area
DDB6	228	CA_parkPct	percent of the non-estuarine contributing area with a zoning category of "park" according to IDPCD
DDB6	229	CA_FedPct	percent of the non-estuarine contributing area with a zoning category of "federal land" according to IDPCD
DDB6	230	CA_RuralPct	percent of the non-estuarine contributing area with a zoning category of "rural" according to IDPCD
DDB6	231	CA_AgRuralPct	percent of the non-estuarine contributing area with a zoning category of "rural agriculture" according to IDPCD

DDB6	232	CA_RurForestPct	percent of the non-estuarine contributing area with a zoning category of "rural forest" according to IDPCD
DDB6	233	CA_RurServPct	percent of the non-estuarine contributing area with a zoning category of "rural service district" according to IDPCD
DDB6	234	CA_RurVillPct	percent of the non-estuarine contributing area with a zoning category of "rural village" according to IDPCD
DDB6	235	CA_RurResPct	percent of the non-estuarine contributing area with a zoning category of "rural residential" according to IDPCD
DDB6	236	CA_MunicPct	percent of the non-estuarine contributing area with a zoning category of "municipality" according to IDPCD
DDB6	237	CA_CommAgPct	percent of the non-estuarine contributing area with a zoning category of "commercial agriculture" according to IDPCD
DDB6	238	CA_RurCtrPct	percent of the non-estuarine contributing area with a zoning category of "rural center" according to IDPCD
DDB6	239	CA_RurAirpPct	percent of the non-estuarine contributing area with a zoning category of "airport" according to IDPCD
DDB6	240	CA_LmfgPct	percent of the non-estuarine contributing area with a zoning category of "light manufacturing" according to IDPCD
DDB6	241	CA_RevDistPct	percent of the non-estuarine contributing area with a zoning category of "review district" according to IDPCD
Bmetrix	1	ID06	numerical identifier for composite wetland polygon, assigned in 2006
Bmetrix	2	ID05	numerical identifier for composite wetland polygon, assigned in 2005
Bmetrix	3	PointID	numerical identifier for sample point within the polygon (1= highest priority sample point/ polygon). Called SiteID in some files.
Bmetrix	4	Visited	1= field data collected in 2005.
Bmetrix	5	Num Strata	number of strata (possible: aquatic bed, emergent, shrub, tree, moss)
Bmetrix	6	Num Spp	total number of plant species (species richness) found in the wetland
Bmetrix	7	AvgWetScore	average moisture score of species present, unweighted by their cover or frequency (values >5 suggest wetland, 10 is the wettest)
Bmetrix	8	MaxWetScore	maximum moisture score of any species present, unweighted by its cover or frequency
Bmetrix	9	OBL spp	number of obligate wetlands species
Bmetrix	10	OBLPct	percent of total species that are obligates
Bmetrix	11	FACW plus spp	number of FacultativeWet+ species (may require more moisture than just FACW)
Bmetrix	12	FACW spp	number of FacultativeWet species
Bmetrix	13	FACplus spp	number of Facultative+ species (may require more moisture than just FAC)
Bmetrix	14	FAC spp	number of Facultative species (species that can occur in wetland OR in uplands)
Bmetrix	15	FAC minus spp	number of Facultative+ species (may require less moisture than just FAC)
Bmetrix	16	FACU spp	number of Facultative Upland species (species that can occur in wetlands but more often in uplands)
Bmetrix	17	FACU minus spp	number of Facultative Uplandminus species (may require even less moisture than FACU)
Bmetrix	18	FACU plus spp	number of Facultative Uplandplus species (may require more moisture than FACU)
Bmetrix	19	FACW minus spp	number of FacultativeWetMinus species (may require less moisture than FACW)

Bmetrix	20	Other Status	number of species whose moisture requirement has not been classified or which are not considered indicators (mostly upland spp)
Bmetrix	21	NonNative Spp	number of non-native species
Bmetrix	22	NonNative Pct	proportion of species that are non-native
Bmetrix	23	Native Spp	number of native species
Bmetrix	24	Unknown Nativ	number of species whose status (native or not) is unknown
Bmetrix	25	NonNtvWetSpp	number of non-native wetland species (species categorized as FAC or wetter)
Bmetrix	26	NtvWetSpp	number of native wetland species (species categorized as FAC or wetter)
Bmetrix	27	NtvWetSppPct	proportion of species that are native wetland species (species categorized as FAC or wetter)
Bmetrix	28	UnkNtvWet	number of species whose status (native or not) and/or moisture requirement is unknown
Bmetrix	29	NonNtvDom	number of dominant species that are non-native
Bmetrix	30	NtvDom	number of dominant species that are native
Bmetrix	31	Avg SalScore	average salt-tolerance score of the species found (1= intolerant, 6= very tolerant)
Bmetrix	32	Max SalScore	maximum salt-tolerance score of any species found (1= intolerant, 6= very tolerant)
Bmetrix	33	Abspp	number of aquatic bed species
Bmetrix	34	Emspp	number of emergent species
Bmetrix	35	ShrubSpp	number of shrub species
Bmetrix	36	TreeSpp	number of tree species
Bmetrix	37	Abnntv	number of aquatic bed species that are non-native
Bmetrix	38	AbnntvPct	proportion of aquatic bed species that are non-native
Bmetrix	39	Emnntv	number of emergent species that are non-native
Bmetrix	40	EmnntvPct	proportion of emergent species that are non-native
Bmetrix	41	ShrubNntv	number of shrub species that are non-native
Bmetrix	42	ShrubNntvPct	proportion of shrub species that are non-native
Bmetrix	43	TreeNntv	number of tree species that are non-native
Bmetrix	44	TreeNntvPct	proportion of tree species that are non-native
Bmetrix	45	Abntv	number of aquatic bed species that are native
Bmetrix	46	Emntv	number of emergent species that are native
Bmetrix	47	ShrubNtv	number of shrub species that are native
Bmetrix	48	TreeNtv	number of tree species that are native
Bmetrix	49	AbwetSpp	number of aquatic bed species that are wetland species (moisture class of FAC or wetter)
Bmetrix	50	EmwetSpp	number of emergent species that are wetland species
Bmetrix	51	Shrub WetSpp	number of wetland shrub species
Bmetrix	52	Tree WetSpp	number of wetland tree species
Bmetrix	53	EMavgWetScore	average moisture score of emergent species present, unweighted by their cover or frequency (values >5 suggest wetland, 10 is the wettest)
Bmetrix	54	ShrubAvg WetScore	average moisture score of shrub species present, unweighted by their cover or frequency (values >5 suggest wetland, 10 is the wettest)
Bmetrix	55	DomSpp	number of species considered dominant within their stratum (aquatic bed, emergent, shrub, tree strata)
Bmetrix	56	DomWet	number of wetland species considered dominant within their stratum
Bmetrix	57	DomWetPct	proportion of dominant species that are wetland species
Bmetrix	58	DomNtv	number of native species considered dominant within their stratum
Bmetrix	59	DomNntv	number of non-native species considered dominant within their stratum

Bmetrix	60	DomNntvPct	proportion of species dominant within their stratum that are non-native
Bmetrix	61	Dom WetNtv	number of native wetland species considered dominant within their stratum
Bmetrix	62	Dom WetNtvPct	proportion of native wetland species that are considered dominant within their stratum
Bmetrix	63	Dom WetNntv	number of non-native wetland species considered dominant within their stratum
Bmetrix	64	DomAvg WetScore	average moisture score of dominant species present, unweighted by their cover or frequency (values >5 suggest wetland, 10 is the wettest)
Bmetrix	65	DomMaxWetScore	maximum moisture score of any dominant species present, unweighted by cover or frequency (values >5 suggest wetland, 10 is the wettest)
Bmetrix	66	DomAvg SalScore	average salt-tolerance score of the dominant species found (1= intolerant, 6= very tolerant)
Bmetrix	67	DomMax SalScore	maximum salt-tolerance score of any dominant species found (1= intolerant, 6= very tolerant)
Bmetrix	68	NotNox	number of plant species found in the wetland that are NOT classified as noxious
Bmetrix	69	Nox1	number of plant species found in the wetland that are classified as noxious in Island County
Bmetrix	70	Nox2	number of plant species found in the wetland that are classified as noxious elsewhere in Washington State
Bmetrix	71	Nox12	number of plant species found in the wetland that are classified as noxious in either Island County or elsewhere in Washington State
Bmetrix	72	NoDomNox	number of plant species found to dominate in the wetland that are NOT classified as noxious
Bmetrix	73	DomNox1	number of plant species found to dominate in the wetland that are classified as noxious in Island County
Bmetrix	74	DomNox2	number of plant species found to dominate in the wetland that are classified as noxious elsewhere in Washington State
Bmetrix	75	DomNox12	number of plant species found to dominate in the wetland that are classified as noxious in either Island County or elsewhere in Washington State
Change85_98	1	ID06	numerical identifier for composite wetland polygon, assigned in 2006
Change85_98	2	Change	n= no apparent negative change; Y= apparent clearing of vegetation or addition of building or road between 1985 and 1998 in wetland or within 300 ft of assumed wetland boundary
Change85_98	3	Wetland Impact	narrative description of apparent changes within the wetland between 1985 and 1998
Change85_98	4	ClearIn Wet	approximate location of new vegetation clearings within the wetland between 1985 and 1998
Change85_98	5	RdInWet	approximate location of new roads within the wetland between 1985 and 1998
Change85_98	6	BldgInWet	approximate location of new buildings within the wetland between 1985 and 1998
Change85_98	7	PdInWet	approximate location of new ponds constructed within the wetland between 1985 and 1998
Change85_98	8	SumInWet	number of different types of changes within the wetland between 1985 and 1998
Change85_98	9	NE	type and number of apparent alterations in the Northeast sector of the numbered zone (1= 0-25 ft zone; 7= 200-300 ft zone); C= clearing, R= road; B= building; P= pond added [North sector was also interpreted but

			accidentally deleted from the file; it is included in the sums]
Change85_98	10	E	type and number of apparent alterations in the East sector of the numbered zone (1= 0-25 ft zone; 7= 200-300 ft zone); C= clearing
Change85_98	11	SE	type and number of apparent alterations in the Southeast sector of the numbered zone (1= 0-25 ft zone; 7= 200-300 ft zone); C= clearing
Change85_98	12	S	type and number of apparent alterations in the South sector of the numbered zone (1= 0-25 ft zone; 7= 200-300 ft zone); C= clearing
Change85_98	13	SW	type and number of apparent alterations in the Southwest sector of the numbered zone (1= 0-25 ft zone; 7= 200-300 ft zone); C= clearing
Change85_98	14	W	type and number of apparent alterations in the West sector of the numbered zone (1= 0-25 ft zone; 7= 200-300 ft zone); C= clearing
Change85_98	15	NW	type and number of apparent alterations in the Northwest sector of the numbered zone (1= 0-25 ft zone; 7= 200-300 ft zone); C= clearing
Change85_98	16	Zone0_25	change within 25 ft of assumed wetland boundary (C=clearing; B=building;R=road or driveway) between 1985 and 1998
Change85_98	17	Zone25_50	change within 25-50 ft of assumed wetland boundary (C=clearing; B=building;R=road or driveway) between 1985 and 1998
Change85_98	18	Zone50_75	change within 50_75 ft of assumed wetland boundary (C=clearing; B=building;R=road or driveway) between 1985 and 1998
Change85_98	19	Zone75_100	change within 75_100 ft of assumed wetland boundary (C=clearing; B=building;R=road or driveway) between 1985 and 1998
Change85_98	20	Csum100	number of buffer sectors with new clearings in the 0-100 ft zone
Change85_98	21	Rsum100	number of buffer sectors with new roads in the 0-100 ft zone
Change85_98	22	Bsum100	number of buffer sectors with new buildings in the 0-100 ft zone
Change85_98	23	Any100	number of buffer sectors with any new alteration in the 0-100 ft zone
Change85_98	24	Zone100_150	change within 100_150 ft of assumed wetland boundary (C=clearing; B=building;R=road or driveway) between 1985 and 1998
Change85_98	25	Zone150_200	change within 150_200 ft of assumed wetland boundary (C=clearing; B=building;R=road or driveway) between 1985 and 1998
Change85_98	26	Zone200_300	change within 200_300 ft of assumed wetland boundary (C=clearing; B=building;R=road or driveway) between 1985 and 1998
Change85_98	27	SumZone1_2	sum of changes (all types) within 50 ft of assumed wetland boundary between 1985 and 1998
Change85_98	28	SumCbuff	number of new vegetation clearings within 300 ft of assumed wetland boundary between 1985 and 1998
Change85_98	29	SumRbuff	number of new roads within 300 ft of assumed wetland boundary between 1985 and 1998
Change85_98	30	SumBbuff	number of new buildings within 300 ft of assumed wetland boundary between 1985 and 1998
Change85_98	31	SumAllBuff	sum of changes (all types) within 300 ft of assumed wetland boundary between 1985 and 1998
Change98_05	1	Id06	numerical identifier for composite wetland polygon, assigned in 2006
Change98_05	2	Change?	n= no apparent change; Y= apparent clearing of vegetation or addition of building or road between 1985 and 1998 within 300 ft of assumed wetland boundary

Change98_05	3	InWet	narrative description of apparent changes within the wetland between 1985 and 1998
Change98_05	4	WetC	approximate location of new vegetation clearings within the wetland between 1985 and 1998
Change98_05	5	WetR	approximate location of new roads within the wetland between 1985 and 1998
Change98_05	6	WetB	approximate location of new buildings within the wetland between 1985 and 1998
Change98_05	7	WetP	approximate location of new ponds constructed within the wetland between 1985 and 1998
Change98_05	8	InWetSum	number of different types of changes within the wetland between 1985 and 1998
Change98_05	9	N	type and number of apparent alterations in the North sector of the numbered zone (1= 0-25 ft zone; 7= 200-300 ft zone); C= clearing
Change98_05	10	NE	type and number of apparent alterations in the Northeast sector of the numbered zone (1= 0-25 ft zone; 7= 200-300 ft zone); C= clearing, R= road; B= building; P= pond added [North sector was also interpreted but accidentally deleted from the file; it is included in the sums]
Change98_05	11	E	type and number of apparent alterations in the East sector of the numbered zone (1= 0-25 ft zone; 7= 200-300 ft zone); C= clearing
Change98_05	12	SE	type and number of apparent alterations in the Southeast sector of the numbered zone (1= 0-25 ft zone; 7= 200-300 ft zone); C= clearing
Change98_05	13	S	type and number of apparent alterations in the South sector of the numbered zone (1= 0-25 ft zone; 7= 200-300 ft zone); C= clearing
Change98_05	14	SW	type and number of apparent alterations in the Southwest sector of the numbered zone (1= 0-25 ft zone; 7= 200-300 ft zone); C= clearing
Change98_05	15	W	type and number of apparent alterations in the West sector of the numbered zone (1= 0-25 ft zone; 7= 200-300 ft zone); C= clearing
Change98_05	16	NW	type and number of apparent alterations in the Northwest sector of the numbered zone (1= 0-25 ft zone; 7= 200-300 ft zone); C= clearing
Change98_05	17	Z1	change within 25 ft of assumed wetland boundary (C=clearing; B=building;R=road or driveway) between 1985 and 1998
Change98_05	18	Z2	change within 25-50 ft of assumed wetland boundary (C=clearing; B=building;R=road or driveway) between 1985 and 1998
Change98_05	19	Z3	change within 50_75 ft of assumed wetland boundary (C=clearing; B=building;R=road or driveway) between 1985 and 1998
Change98_05	20	Z4	change within 75_100 ft of assumed wetland boundary (C=clearing; B=building;R=road or driveway) between 1985 and 1998
Change98_05	21	C100	number of buffer sectors with new clearings in the 0-100 ft zone
Change98_05	22	R100	number of buffer sectors with new roads in the 0-100 ft zone
Change98_05	23	B100	number of buffer sectors with new buildings in the 0-100 ft zone
Change98_05	24	Any100	number of buffer sectors with any new alteration in the 0-100 ft zone
Change98_05	25	Z5	change within 100_150 ft of assumed wetland boundary (C=clearing; B=building;R=road or driveway) between 1985 and 1998
Change98_05	26	Z6	change within 150_200 ft of assumed wetland boundary (C=clearing; B=building;R=road or driveway) between 1985 and 1998
Change98_05	27	Z7	change within 200_300 ft of assumed wetland boundary (C=clearing; B=building;R=road or driveway) between 1985 and 1998
Change98_05	28	SumC	number of new vegetation clearings within 300 ft of assumed wetland boundary between 1985 and 1998
Change98_05	29	SumR	number of new roads within 300 ft of assumed wetland boundary between 1985 and 1998
Change98_05	30	SumB	number of new buildings within 300 ft of assumed wetland boundary between

			1985 and 1998
Change98_05	31	Note	sum of changes (all types) within 300 ft of assumed wetland boundary between 1985 and 1998
Improve85	1	ID06wet	numerical identifier for composite wetland polygon, assigned in 2006
Improve85	2	Change	n= no apparent positive change (recovery to natural state, i.e., improvement); Y= apparent positive change between 1985 and 1998 in wetland or within 100 ft of assumed wetland boundary
Improve85	3	Wetland Improvements	narrative description of type, number, and location of positive changes
Improve85	4	VG	vegetation regrowth (mainly increased canopy cover) noted between 1985 and 1998
Improve85	5	RR	road removal noted between 1985 and 1998
Improve85	6	RO	road overgrowth (mainly by canopy) noted between 1985 and 1998
Improve85	7	PR	pond was removed between 1985 and 1998
Improve85	8	C	vegetation regrowth (mainly in bare or very open areas) noted between 1985 and 1998
Improve85	9	BR	building(s) removed between 1985 and 1998
Improve85	10	PC	pond(s) created between 1985 and 1998
Improve85	11	sumW	sum of the above positive changes within the wetland
Improve85	12	N	type and number of apparent improvements in the North sector of the numbered zone (1= 0-25 ft zone; 7= 200-300 ft zone)
Improve85	13	NE	type and number of apparent improvements in the Northeast sector of the numbered zone (1= 0-25 ft zone; 7= 200-300 ft zone)
Improve85	14	E	type and number of apparent improvements in the East sector of the numbered zone (1= 0-25 ft zone; 7= 200-300 ft zone);
Improve85	15	SE	type and number of apparent improvements in the Southeast sector of the numbered zone (1= 0-25 ft zone; 7= 200-300 ft zone);
Improve85	16	S	type and number of apparent improvements in the South sector of the numbered zone (1= 0-25 ft zone; 7= 200-300 ft zone);
Improve85	17	SW	type and number of apparent improvements in the Southwest sector of the numbered zone (1= 0-25 ft zone; 7= 200-300 ft zone);
Improve85	18	W	type and number of apparent improvements in the West sector of the numbered zone (1= 0-25 ft zone; 7= 200-300 ft zone);
Improve85	19	NW	type and number of apparent improvements in the Northwest sector of the numbered zone (1= 0-25 ft zone; 7= 200-300 ft zone);
Improve85	20	note	explanation of the buffer improvements
Improve85	21	B1	type and number of sectors with improvements in 0-25 ft surrounding zone
Improve85	22	B2	type and number of sectors with improvements in 25-50 ft surrounding zone
Improve85	23	B3	type and number of sectors with improvements in 50-75 ft surrounding zone
Improve85	24	B4	type and number of sectors with improvements in 75-100 ft surrounding zone
Improve85	25	VGsum100	sum of VG within the 0-100 ft zones
Improve85	26	RRsum100	sum of RR within the 0-100 ft zones
Improve85	27	ROsum100	sum of RO within the 0-100 ft zones
Improve85	28	PR_sum100	sum of PR within the 0-100 ft zones
Improve85	29	C_sum100	sum of C within the 0-100 ft zones
Improve85	30	BR_sum100	sum of BR within the 0-100 ft zones
Improve85	31	PC_sum100	sum of PC within the 0-100 ft zones
Improve85	32	AnyBuff100	sum of all improvements within the 0-100 ft zones
WDOEitems	1	ID06	numerical identifier for composite wetland polygon, assigned in 2006
WDOEitems	2	ID05	numerical identifier for composite wetland polygon, assigned in 2005
WDOEitems	3	PointID	numerical identifier for sample point within the polygon (1= highest priority sample point/ polygon). Called SiteID in some files.

WDOEitems	4	Visited	1= field data collected in 2005.
WDOEitems	5	C1	Tidal Fringe
WDOEitems	6	C1.1	Freshwater Tidal Fringe
WDOEitems	7	C1.2	Salt Water Tidal Fringe (Estuarine)
WDOEitems	8	C2	Flats
WDOEitems	9	C3	Lacustrine Fringe
WDOEitems	10	C3.1	>20 acres open water
WDOEitems	11	C3.2	>30% of open water is deepwater
WDOEitems	12	C4	Slope
WDOEitems	13	C4.1	Slope -on a slope
WDOEitems	14	C4.2	Slope- unidirectional flow
WDOEitems	15	C4.3	Slope- unimpounded exit
WDOEitems	16	C5	Riverine
WDOEitems	17	C6	Depressional wetland WDOE
WDOEitems	18	C7	Depressional wetland WDOE
WDOEitems	19	C8	Multiclass
WDOEitems	20	C8.1	Slope & Riverine
WDOEitems	21	C8.2	Slope & Depressional
WDOEitems	22	C8.3	Slope & Lake-fringe
WDOEitems	23	C8.4	Depressional & Riverine along stream with boundary
WDOEitems	24	C8.5	Depressional & Lake-fringe
WDOEitems	25	C8.6	Salt Water Tidal Fringe & any other class of freshwater wetland
WDOEitems	26	C9	>2 HGM classes, or default
WDOEitems	27	D1.1.1	Depression no outlet
WDOEitems	28	D1.1.2	Constricted or intermittent outlet
WDOEitems	29	D1.1.3	Unconstricted outlet
WDOEitems	30	D1.1.4	No outlet or outlet is ditch
WDOEitems	31	D1.2	Clay, organic, or hydrogen sulfide in upper 2" of soil
WDOEitems	32	D1.3.1	Dense persistent ungrazed veg is >95% of area
WDOEitems	33	D1.3.2	is >50%
WDOEitems	34	D1.3.3	is >10%
WDOEitems	35	D1.3.4	is <10%
WDOEitems	36	D1.4.1	Seasonal is >50% of area
WDOEitems	37	D1.4.2	>25%
WDOEitems	38	D1.4.3	<25%
WDOEitems	39	D2.1	Grazed within 150 ft
WDOEitems	40	D2.2	Stormwater flows into wetland
WDOEitems	41	D2.3	Tilled fields or orchards within 150 ft
WDOEitems	42	D2.4	Channel from developed or farmed or roads or clearcut
WDOEitems	43	D2.5	Residential, urban, or golf courses within 150 ft
WDOEitems	44	D2.6	Enriched groundwater
WDOEitems	45	D2.7	other source of potential contaminants
WDOEitems	46	D3.1.1	No outlet
WDOEitems	47	D3.1.2	Constricted or intermittent outlet
WDOEitems	48	D3.1.3	No outlet or outlet is ditch
WDOEitems	49	D3.1.4	Unconstricted outlet
WDOEitems	50	D3.2.1	>3 ft storage
WDOEitems	51	D3.2.2	Headwater position

WDOEitems	52	D3.2.3	2-3 ft storage
WDOEitems	53	D3.2.4	0.5-2ft storage
WDOEitems	54	D3.2.5	flat with small depressions
WDOEitems	55	D3.2.6	<0.5 ft storage
WDOEitems	56	D3.3.1	Basin is <10x wetland area
WDOEitems	57	D3.3.2	Basin is 10-100x wetland area
WDOEitems	58	D3.3.3	Basin is >100x wetland area
WDOEitems	59	D3.3.4	Basin is a flat
WDOEitems	60	D4.1	Headwater of channel with Flooding Problems
WDOEitems	61	D4.2	drains to channel with Flooding Problems
WDOEitems	62	D4.3	No outlet and impounds surface water
WDOEitems	63	D4.4	other
WDOEitems	64	R1.1.1	Depressions >75% of area
WDOEitems	65	R1.1.2	Depressions >50%
WDOEitems	66	R1.1.3	Depressions <50%
WDOEitems	67	R1.1.4	No depressions
WDOEitems	68	R1.2.1	Forest or shrub >2/3 of area
WDOEitems	69	R1.2.2	Forest or shrub >1/3 of area
WDOEitems	70	R1.2.3	Ungrazed emergents >2/3 of area
WDOEitems	71	R1.2.4	Ungrazed emergents >1/3 of area
WDOEitems	72	R1.2.5	Forest, shrub, and ungrazed emergent are <1/3 of area
WDOEitems	73	R2.1	Grazed within 150 ft
WDOEitems	74	R2.2	Stormwater
WDOEitems	75	R2.3	Tilled fields or orchards within 150 ft
WDOEitems	76	R2.4	Channel from developed or farmed or roads or clearcut
WDOEitems	77	R2.5	Residential, urban, or golf courses within 150 ft
WDOEitems	78	R2.6	Contributing channel has excessive sediments, toxics, or nutrients
WDOEitems	79	R2.7	other source of potential contaminants
WDOEitems	80	R3.1.1	wetland width relative to channel width is >20
WDOEitems	81	R3.1.2	wetland width relative to channel width is 10-20
WDOEitems	82	R3.1.3	wetland width relative to channel width is 5-10
WDOEitems	83	R3.1.4	wetland width relative to channel width is 1-5
WDOEitems	84	R3.1.5	wetland width relative to channel width is <1
WDOEitems	85	R3.2.1	>1/3 woody or >2/3 emergents
WDOEitems	86	R3.2.2	>1/10 woody or >1/3 emergents
WDOEitems	87	R3.2.3	neither+D525
WDOEitems	88	R4.1	flood-vulnerable human structures or activities downstream
WDOEitems	89	R4.2	flood-vulnerable natural resource downstream
WDOEitems	90	R4.3	other flood-vulnerable area
WDOEitems	91	L1.1.1	veg >10m wide
WDOEitems	92	L1.1.2	veg >5m wide
WDOEitems	93	L1.1.3	veg>2m wide
WDOEitems	94	L1.1.4	veg <2m wide
WDOEitems	95	L1.2.1	herbs >90% of vegetated area
WDOEitems	96	L1.2.2	herbs cover >2/3 of vegetated area
WDOEitems	97	L1.2.3	herbs cover >1/3 of vegetated area
WDOEitems	98	L1.2.4	non-herbs cover >2/3 of vegetated area
WDOEitems	99	L1.2.5	non-herbs cover >1/3 of vegetated area
WDOEitems	100	L1.2.6	aquatic bed covers >2/3 of vegetated area
WDOEitems	101	L2.1	on shore of non-attainment lake

WDOEitems	102	L2.3	grazed within 150 ft
WDOEitems	103	L2.4	polluted discharges to wetland along upland edge
WDOEitems	104	L2.5	tilled fields or orchards within 150 ft
WDOEitems	105	L2.6	residential, urban, or golf courses within 150 ft
WDOEitems	106	L2.7	parks with lawns within 150 ft of shore
WDOEitems	107	L2.8	powerboats on the lake
WDOEitems	108	L2.9	other
WDOEitems	109	L3.1	>75% of veg is woody >10m wide
WDOEitems	110	L3.2	>75% of veg is woody >2m wide
WDOEitems	111	L3.3	>25% of veg is woody >10m wide
WDOEitems	112	L3.4	other fringe >2m wide
WDOEitems	113	L3.5	other fringe <2m wide
WDOEitems	114	L4.1	structures vulnerable to erosion
WDOEitems	115	L4.2	natural resources vulnerable to erosion
WDOEitems	116	L4.3	other
WDOEitems	117	S1.1.1	Slope <1%
WDOEitems	118	S1.1.2	Slope 1-2%
WDOEitems	119	S1.1.3	Slope 2-5%
WDOEitems	120	S1.1.4	Slope >5%
WDOEitems	121	S1.2	Clay, organic, or hydrogen sulfide in upper 2" of soil
WDOEitems	122	S1.3.1	Dense persistent ungrazed herb is >90% of area
WDOEitems	123	S1.3.2	Dense persistent ungrazed herb is >50% of area
WDOEitems	124	S1.3.3	Dense woody is >50% of area
WDOEitems	125	S1.3.4	Dense persistent ungrazed herb is >25% of area
WDOEitems	126	S1.3.5	none of above
WDOEitems	127	S2.1	Grazed within 150 ft
WDOEitems	128	S2.2	Stormwater
WDOEitems	129	S2.3	Tilled fields or orchards within 150 ft
WDOEitems	130	S2.4	Residential, urban, or golf courses within 150 ft
WDOEitems	131	S2.5	other
WDOEitems	132	S3.1.1	Dense unmatted rigid veg covers >90%
WDOEitems	133	S3.1.2	Dense unmatted rigid veg covers >50%
WDOEitems	134	S3.1.3	Dense unmatted rigid veg covers >25%
WDOEitems	135	S3.1.4	>25% is not rigid or is grazed, mowed, or tilled
WDOEitems	136	S3.2	microdepressions occupy >10% of area
WDOEitems	137	S4.1	drains to channel with flooding problems
WDOEitems	138	S4.2	other
WDOEitems	139	H1.1.1	Aquatic bed >10% of area or >1/4 acre
WDOEitems	140	H1.1.2	Emergents
WDOEitems	141	H1.1.3	Scrub-shrub with >30% cover
WDOEitems	142	H1.1.4	Forested with >30% cover
WDOEitems	143	H1.1.5	Forested has 3 of 5 strata
WDOEitems	144	H1.1	Points for number of qualifying types
WDOEitems	145	H1.2.1	Permanently inundated
WDOEitems	146	H1.2.2	Seasonally
WDOEitems	147	H1.2.3	Occasionally
WDOEitems	148	H1.2.4	Saturated
WDOEitems	149	H1.2.5	permanent Stream in or adjoining wetland
WDOEitems	150	H1.2.6	seasonal Stream in or adjoining wetland
WDOEitems	151	H1.2.7	Lake-fringe wetland

WDOEitems	152	H1.2.8	Freshwater Tidal wetland
WDOEitems	153	H1.2	Points for number of hydroperiod types
WDOEitems	154	H1.3	Points for number of plant species excluding 4 invasives
WDOEitems	155	H1.4	Interspersion
WDOEitems	156	H1.5.1	LWD
WDOEitems	157	H1.5.2	Snags
WDOEitems	158	H1.5.3	Undercut banks
WDOEitems	159	H1.5.4	Steep banks
WDOEitems	160	H1.5.5	Amphibian stems -- 1/4 acre
WDOEitems	161	H1.5.6	the 4 invasives are <25% of area in each stratum
WDOEitems	162	H1.5	Points for Special Habitat Features
WDOEitems	163	H2.1.1	100m of undisturbed occupies >95% of edge
WDOEitems	164	H2.1.2	100m of undisturbed occupies >50% of edge
WDOEitems	165	H2.1.3	50m of undisturbed occupies >95% of edge
WDOEitems	166	H2.1.4	100m of undisturbed occupies >25% of edge
WDOEitems	167	H2.1.5	50m of undisturbed occupies >50% of edge
WDOEitems	168	H2.1.6	no paved or buildings within 25m of 95% of edge
WDOEitems	169	H2.1.7	no paved or buildings within 50m of 50% of edge
WDOEitems	170	H2.1.8	buffer heavily grazed
WDOEitems	171	H2.1.9	2m of undisturbed occupies >95% of edge
WDOEitems	172	H2.1.10	none of above
WDOEitems	173	H2.2.1	corridor >150' wide AND >30% undisturbed AND connects to >250 acres other undisturbed
WDOEitems	174	H2.2.2	corridor >50' wide AND >30% undisturbed AND connects to >25 acres other undisturbed
WDOEitems	175	H2.2.3	within 5 mi of estuary OR 3 mi of field (>40 ac) OR 1 mi of a lake
WDOEitems	176	H2.3.1	Riparian
WDOEitems	177	H2.3.2	Aspen
WDOEitems	178	H2.3.3	Cliffs
WDOEitems	179	H2.3.4	Oldgrowth
WDOEitems	180	H2.3.5	Mature forest
WDOEitems	181	H2.3.6	Prairies
WDOEitems	182	H2.3.7	Talus
WDOEitems	183	H2.3.8	Caves
WDOEitems	184	H2.3.9	Oregon white oak
WDOEitems	185	H2.3.10	Urban natural space
WDOEitems	186	H2.3.11	Estuary
WDOEitems	187	H2.3.12	Marine shoreline
WDOEitems	188	H2.3	Points for total number of Priority Habitats
WDOEitems	189	H2.4.1	3+ other wetlands within 1/2 mile and minor connector disturbance
WDOEitems	190	H2.4.2	lake-fringe wetland with minor lake disturbance and 3+ others within 1/2 mile
WDOEitems	191	H2.4.3	3+ other wetlands within 1/2 mile and major connector disturbance
WDOEitems	192	H2.4.4	lake-fringe wetland with major lake disturbance and 3+ others within 1/2 mile
WDOEitems	193	H2.4.5	1+ wetland within 1/2 mile
WDOEitems	194	H2.4.6	none of above
WDOEitems	195	SC1.0.1	tidal dominates
WDOEitems	196	SC1.0.2	vegetated and estuarine
WDOEitems	197	SC1.0.3	salinity >0.5 ppt

WDOEitems	198	SC1.1	estuarine and in a designated preserve or park or refuge
WDOEitems	199	SC1.2	>1 acre AND estuarine
WDOEitems	200	SC1.2.1	estuarine and undisturbed and <10% non-native
WDOEitems	201	SC1.2.2	estuarine and upland edge has >100 ft undisturbed
WDOEitems	202	SC1.2.3	estuarine and has tidal channels, pans, or contiguous freshwater
WDOEitems	203	SC2.1	wetland in a township-range-section containing WNHP wetland
WDOEitems	204	SC2.2	DNR designated due to rare plants or high quality wetland
WDOEitems	205	SC3.1	peat or muck comprise >16 inches of soil profile
WDOEitems	206	SC3.2	peat or muck with hardpan (clay or ash), or floating in lake
WDOEitems	207	SC3.3	>70% moss cover and bog plants comprise >30% cover
WDOEitems	208	SC3.4	>30% cover of wetland forest plus bog plants comprise >30% ground cover
WDOEitems	209	SC4.1	8 trees/ac that are >200 yrs old or with dbh >32 inches
WDOEitems	210	SC4.2	stands of trees 80-200 yrs old or with dbh >21 inches
WDOEitems	211	SC5.0.1	lagoon separated from marine by sand or gravel banks
WDOEitems	212	SC5.0.2	salinity >0.5 ppt during most of year in some portion of lagoon
WDOEitems	213	SC5.1.1	lagoon & undisturbed and <20% cover of invasive plant species
WDOEitems	214	SC5.1.2	lagoon and >75% of edge has 100 ft undisturbed buffer
WDOEitems	215	SC5.1.3	lagoon and wetland is >1/10 acre
BotSpMatrix	1	ID06	numerical identifier for composite wetland polygon, assigned in 2006
BotSpMatrix	2	AGCA	Found Agrostis capillaris in wetland
BotSpMatrix	3	AGGI	Found Agrostis gigantea in wetland
BotSpMatrix	4	AGRO_SP	Found Agrostis sp in wetland
BotSpMatrix	5	ALRU	Found Alnus rubra in wetland
BotSpMatrix	6	ANOD	Found Anthoxanthum odoratum in wetland
BotSpMatrix	7	AREG	Found Argentina egedii in wetland
BotSpMatrix	8	ATFI	Found Athryium filix-femina in wetland
BotSpMatrix	9	ATPA	Found Atriplex patula in wetland
BotSpMatrix	10	CADE	Found Carex deweyana in wetland
BotSpMatrix	11	CAOB	Found Carex obnupta in wetland
BotSpMatrix	12	CAREX	Found Carex sp in wetland
BotSpMatrix	13	CIAR	Found Cirsium arvense in wetland
BotSpMatrix	14	CIVU	Found Cirsium vulgare in wetland
BotSpMatrix	15	DISP	Found Distichlis spicata in wetland
BotSpMatrix	16	ELPA	Found Eleocharis palustris in wetland
BotSpMatrix	17	ELRE	Found Eltrygia repens in wetland
BotSpMatrix	18	EPCI	Found Epilobium ciliatum v. watsonii in wetland
BotSpMatrix	19	EQAR	Found Equisetum arvense in wetland
BotSpMatrix	20	EQTE	Found Equisetum telmataeia in wetland
BotSpMatrix	21	FEAR	Found Festuca (Lolium) arundinacea in wetland
BotSpMatrix	22	GAAP	Found Galium aparine in wetland
BotSpMatrix	23	GASH	Found Gaultheria shallon in wetland
BotSpMatrix	24	GATRFI	Found Galium trificum in wetland
BotSpMatrix	25	GEMA	Found Geum maculatum in wetland
BotSpMatrix	26	GLEL	Found Glyceria elata in wetland
BotSpMatrix	27	GRIN	Found Grindelia integrfolia in wetland
BotSpMatrix	28	HOLA	Found Holcus lanatus in wetland
BotSpMatrix	29	HYRA	Found Hypocharis radicata in wetland
BotSpMatrix	30	ILAQ	Found Ilex aquifolium in wetland
BotSpMatrix	31	JACA	Found Jaumaea carnosa in wetland

BotSpMatrix	32	JUBA	Found Juncus balticus in wetland
BotSpMatrix	33	JUEF	Found Juncus effusus in wetland
BotSpMatrix	34	LOIN	Found Lonicera involucrata in wetland
BotSpMatrix	35	LYAM	Found Lycopus americanum in wetland
BotSpMatrix	36	MAFU	Found Malus fusca in wetland
BotSpMatrix	37	MEAR	Found Mentha arvensis in wetland
BotSpMatrix	38	MYLA	Found Myosotis laxa in wetland
BotSpMatrix	39	OECE	Found Oemleria cerasiformis in wetland
BotSpMatrix	40	OELU	Found Nuphar lutea in wetland
BotSpMatrix	41	OESA	Found Oenanthes sarmentosa in wetland
BotSpMatrix	42	PHAR	Found Phalaris arundinacea in wetland
BotSpMatrix	43	PISI	Found Picea sitchensis in wetland
BotSpMatrix	44	PLLA	Found Plantago lanceolata in wetland
BotSpMatrix	45	PLMAR	Found Plantago maritima in wetland
BotSpMatrix	46	POMU	Found Polystichum munitum in wetland
BotSpMatrix	47	POPA	Found Potentilla palustris in wetland
BotSpMatrix	48	PSME	Found Pseudotsuga menziesii in wetland
BotSpMatrix	49	PTAQ	Found Pteridium aquilinum in wetland
BotSpMatrix	50	RARE	Found Ranunculus repens in wetland
BotSpMatrix	51	RINA	Found Ricciocarpos natans in wetland
BotSpMatrix	52	RONU	Found Rosa nutkana in wetland
BotSpMatrix	53	RUCR	Found Rumex crispus in wetland
BotSpMatrix	54	RULA	Found Rubus lacineatus in wetland
BotSpMatrix	55	RUOB	Found Rumex obtusa in wetland
BotSpMatrix	56	RUSP	Found Rumex spectabilis in wetland
BotSpMatrix	57	RUUR	Found Rubus ursinus in wetland
BotSpMatrix	58	SALU	Found Salix lucida in wetland
BotSpMatrix	59	SARA	Found Sambucus racemosa in wetland
BotSpMatrix	60	SASC	Found Salix scouleriana in wetland
BotSpMatrix	61	SASI	Found Salix sitchensis in wetland
BotSpMatrix	62	SAVI	Found Salicornia virginica in wetland
BotSpMatrix	63	SCAC	Found Schoenoplectus (Scirpus) acutus in wetland
BotSpMatrix	64	SOAS	Found Sonchus asper in wetland
BotSpMatrix	65	SODU	Found Solanum dulcamara in wetland
BotSpMatrix	66	SPDO	Found Spiraea douglasii in wetland
BotSpMatrix	67	STCH	Found Stachys chamissonis in wetland
BotSpMatrix	68	SYAL	Found Symphocarpos alba in wetland
BotSpMatrix	69	THPL	Found Thuja plicata in wetland
BotSpMatrix	70	TOME	Found Tolmeia menziesii in wetland
BotSpMatrix	71	TRMA	Found Triglochin maritima in wetland
BotSpMatrix	72	TRRE	Found Trifolium repens in wetland
BotSpMatrix	73	TSHE	Found Tsuga heterophylla in wetland
BotSpMatrix	74	TYLA	Found Typha latifolia in wetland
BotSpMatrix	75	URDI	Found Urtica dioica in wetland
BotSpMatrix	76	VAPA	Found Vaccinium parvifolium in wetland
BotSpMatrix	77	VEAM	Found Veronica americana in wetland
BotSpMatrix	78	VESC	Found Veronica scutellaria in wetland
BuffLcov	1	ID06	numerical identifier for composite wetland polygon, assigned in 2006
BuffLcov	2	ID05	numerical identifier for composite wetland polygon, assigned in 2005

BuffLcov	3	PointID	numerical identifier for sample point within the wetland polygon (1= highest priority sample point/ polygon). Called SiteID in some files.
BuffLcov	4	Visited	1= field data collected in 2005.
BuffLcov	5	AcresWetland	area of the composite wetland polygon with which the zone is associated
BuffLcov	6	Acres50	acreage of the 0-50 ft zone
BuffLcov	7	Acres100	acreage of the 50-100 ft zone
BuffLcov	8	Acres150	acreage of the 100-150 ft zone
BuffLcov	9	Acres300	acreage of the 150-300 ft zone
BuffLcov	10	DomLC50	name of most extensive land cover type in the 0-50 ft zone
BuffLcov	11	DomLC100	name of most extensive land cover type in the 50-100 ft zone
BuffLcov	12	DomLC150	name of most extensive land cover type in the 100-150 ft zone
BuffLcov	13	DomLC300	name of most extensive land cover type in the 150-300 ft zone
BuffLcov	14	Park50	% of the 0-50 ft zone that is zoned as "park"
BuffLcov	15	Park100	% of the 50-100 ft zone that is zoned as "park"
BuffLcov	16	Park150	% of the 100-150 ft zone that is zoned as "park"
BuffLcov	17	Park300	% of the 150-300 ft zone that is zoned as "park"
BuffLcov	18	FedLand50	% of the 0-50 ft zone that is zoned as "Federal Land"
BuffLcov	19	FedLand100	% of the 50-100 ft zone that is zoned as "Federal Land"
BuffLcov	20	FedLand150	% of the 100-150 ft zone that is zoned as "Federal Land"
BuffLcov	21	FedLand300	% of the 150-300 ft zone that is zoned as "Federal Land"
BuffLcov	22	Rural50	% of the 0-50 ft zone that is zoned as "Rural"
BuffLcov	23	Rural100	% of the 50-100 ft zone that is zoned as "Rural"
BuffLcov	24	Rural150	% of the 100-150 ft zone that is zoned as "Rural"
BuffLcov	25	Rural300	% of the 150-300 ft zone that is zoned as "Rural"
BuffLcov	26	AgRural50	% of the 0-50 ft zone that is zoned as "Rural Agriculture"
BuffLcov	27	AgRural100	% of the 50-100 ft zone that is zoned as "Rural Agriculture"
BuffLcov	28	AgRural150	% of the 100-150 ft zone that is zoned as "Rural Agriculture"
BuffLcov	29	AgRural300	% of the 150-300 ft zone that is zoned as "Rural Agriculture"
BuffLcov	30	RuralRes50	% of the 0-50 ft zone that is zoned as "Rural Residential"
BuffLcov	31	RuralRes100	% of the 50-100 ft zone that is zoned as "Rural Residential"
BuffLcov	32	RuralRes150	% of the 100-150 ft zone that is zoned as "Rural Residential"
BuffLcov	33	RuralRes300	% of the 150-300 ft zone that is zoned as "Rural Residential"
BuffLcov	34	AgComm50	% of the 0-50 ft zone that is zoned as "Commercial Agriculture"
BuffLcov	35	AgComm100	% of the 50-100 ft zone that is zoned as "Commercial Agriculture"
BuffLcov	36	AgComm150	% of the 100-150 ft zone that is zoned as "Commercial Agriculture"
BuffLcov	37	AgComm300	% of the 150-300 ft zone that is zoned as "Commercial Agriculture"
BuffLcov	38	Municip50	% of the 0-50 ft zone that is zoned as "Municipality"
BuffLcov	39	Municip100	% of the 50-100 ft zone that is zoned as "Municipality"
BuffLcov	40	Municip150	% of the 100-150 ft zone that is zoned as "Municipality"
BuffLcov	41	Municip300	% of the 150-300 ft zone that is zoned as "Municipality"
BuffLcov	42	RuralVill50	% of the 0-50 ft zone that is zoned as "Rural Village"
BuffLcov	43	RuralVill100	% of the 50-100 ft zone that is zoned as "Rural Village"
BuffLcov	44	RuralVill150	% of the 100-150 ft zone that is zoned as "Rural Village"
BuffLcov	45	RuralVill300	% of the 150-300 ft zone that is zoned as "Rural Village"
BuffLcov	46	RuralForest50	% of the 0-50 ft zone that is zoned as "Rural Forest"
BuffLcov	47	RuralForest150	% of the 50-100 ft zone that is zoned as "Rural Forest"
BuffLcov	48	RuralForest300	% of the 100-150 ft zone that is zoned as "Rural Forest"
BuffLcov	49	RuralForest100	% of the 150-300 ft zone that is zoned as "Rural Forest"

BuffLcov	50	RuralCtr50	% of the 0-50 ft zone that is zoned as "Rural Center"
BuffLcov	51	RuralCtr100	% of the 50-100 ft zone that is zoned as "Rural Center"
BuffLcov	52	RuralCtr150	% of the 100-150 ft zone that is zoned as "Rural Center"
BuffLcov	53	RuralCtr300	% of the 150-300 ft zone that is zoned as "Rural Center"
BuffLcov	54	LiteMfg50	% of the 0-50 ft zone that is zoned as "Light Manufacturing"
BuffLcov	55	LiteMfg100	% of the 50-100 ft zone that is zoned as "Light Manufacturing"
BuffLcov	56	LiteMfg150	% of the 100-150 ft zone that is zoned as "Light Manufacturing"
BuffLcov	57	LiteMfg300	% of the 150-300 ft zone that is zoned as "Light Manufacturing"
BuffLcov	58	Airpt50	% of the 0-50 ft zone that is zoned as "Airport"
BuffLcov	59	Airpt100	% of the 50-100 ft zone that is zoned as "Airport"
BuffLcov	60	Airpt150	% of the 100-150 ft zone that is zoned as "Airport"
BuffLcov	61	Airpt300	% of the 150-300 ft zone that is zoned as "Airport"
BuffLcov	62	RuralServ50	% of the 0-50 ft zone that is zoned as "Rural Service"
BuffLcov	63	RuralServ100	% of the 50-100 ft zone that is zoned as "Rural Service"
BuffLcov	64	RuralServ150	% of the 100-150 ft zone that is zoned as "Rural Service"
BuffLcov	65	RuralServ300	% of the 150-300 ft zone that is zoned as "Rural Service"
BuffLcov	66	RevuDist50	% of the 0-50 ft zone that is zoned as "Review District"
BuffLcov	67	RevuDist100	% of the 50-100 ft zone that is zoned as "Review District"
BuffLcov	68	RevuDist150	% of the 100-150 ft zone that is zoned as "Review District"
BuffLcov	69	RevuDist300	% of the 150-300 ft zone that is zoned as "Review District"
BuffLcov	70	CDA50	% of the 0-50 ft zone that is a designated "Critical Drainage Area"
BuffLcov	71	CDA100	% of the 50-100 ft zone that is a designated "Critical Drainage Area"
BuffLcov	72	CDA150	% of the 100-150 ft zone that is a designated "Critical Drainage Area"
BuffLcov	73	CDA300	% of the 150-300 ft zone that is a designated "Critical Drainage Area"
BuffLcov	74	FyPct50	% of the 0-50 ft zone for which DNR timber harvest permits have been issued, 1996-2004
BuffLcov	75	FyPct100	% of the 50-100 ft zone for which DNR timber harvest permits have been issued, 1996-2004
BuffLcov	76	FyPct150	% of the 100-150 ft zone for which DNR timber harvest permits have been issued, 1996-2004
BuffLcov	77	FyPct300	% of the 150-300 ft zone for which DNR timber harvest permits have been issued, 1996-2004
BuffLcov	78	RdFt50	length (ft) of road within the 0-50 ft zone
BuffLcov	79	RdFt100	length (ft) of road within the 50-100 ft zone
BuffLcov	80	RdFt150	length (ft) of road within the 100-150 ft zone
BuffLcov	81	RdFt300	length (ft) of road within the 150-300 ft zone
BuffLcov	82	DevelHiDens50	% of the 0-50 ft zone classified as Developed High Density (from 1998 satellite imagery)
BuffLcov	83	DevelHiDens100	% of the 50-100 ft zone classified as Developed High Density (from 1998 satellite imagery)
BuffLcov	84	DevelHiDens150	% of the 100-150 ft zone classified as Developed High Density (from 1998 satellite imagery)
BuffLcov	85	DevelHiDens300	% of the 150-300 ft zone classified as Developed High Density (from 1998 satellite imagery)
BuffLcov	86	DevelLoDens50	% of the 0-50 ft zone classified as Developed Low Density (from 1998 satellite imagery)
BuffLcov	87	DevelLoDens100	% of the 50-100 ft zone classified as Developed Low Density (from 1998 satellite imagery)
BuffLcov	88	DevelLoDens150	% of the 100-150 ft zone classified as Developed Low Density (from 1998 satellite imagery)

BuffLcov	89	DevelLoDens300	% of the 150-300 ft zone classified as Developed Low Density (from 1998 satellite imagery)
BuffLcov	90	ForestEvgrOpen50	% of the 0-50 ft zone classified as Open Evergreen Forest (from 1998 satellite imagery)
BuffLcov	91	ForestEvgrOpen100	% of the 50-100 ft zone classified as Open Evergreen Forest (from 1998 satellite imagery)
BuffLcov	92	ForestEvgrOpen150	% of the 100-150 ft zone classified as Open Evergreen Forest (from 1998 satellite imagery)
BuffLcov	93	ForestEvgrOpen300	% of the 150-300 ft zone classified as Open Evergreen Forest (from 1998 satellite imagery)
BuffLcov	94	OWshallow50	% of the 0-50 ft zone classified as Open Water (Shallow) (from 1998 satellite imagery)
BuffLcov	95	OWshallow100	% of the 50-100 ft zone classified as Open Water (Shallow) (from 1998 satellite imagery)
BuffLcov	96	OWshallow150	% of the 100-150 ft zone classified as Open Water (Shallow) (from 1998 satellite imagery)
BuffLcov	97	OWshallow300	% of the 150-300 ft zone classified as Open Water (Shallow) (from 1998 satellite imagery)
BuffLcov	98	OpenWater50	% of the 0-50 ft zone classified as Open Water (from 1998 satellite imagery)
BuffLcov	99	OpenWater100	% of the 50-100 ft zone classified as Open Water (from 1998 satellite imagery)
BuffLcov	100	OpenWater150	% of the 100-150 ft zone classified as Open Water (from 1998 satellite imagery)
BuffLcov	101	OpenWater300	% of the 150-300 ft zone classified as Open Water (from 1998 satellite imagery)
BuffLcov	102	ShrubDecid50	% of the 0-50 ft zone classified as Deciduous Shrub (from 1998 satellite imagery)
BuffLcov	103	ShrubDecid100	% of the 50-100 ft zone classified as Deciduous Shrub (from 1998 satellite imagery)
BuffLcov	104	ShrubDecid150	% of the 100-150 ft zone classified as Deciduous Shrub (from 1998 satellite imagery)
BuffLcov	105	ShrubDecid300	% of the 150-300 ft zone classified as Deciduous Shrub (from 1998 satellite imagery)
BuffLcov	106	Bare50	% of the 0-50 ft zone classified as Bare (from 1998 satellite imagery)
BuffLcov	107	Bare100	% of the 50-100 ft zone classified as Bare (from 1998 satellite imagery)
BuffLcov	108	Bare150	% of the 100-150 ft zone classified as Bare (from 1998 satellite imagery)
BuffLcov	109	Bare300	% of the 150-300 ft zone classified as Bare (from 1998 satellite imagery)
BuffLcov	110	DevelLoDenSS100	% of the 50-100 ft zone classified as Developed Low Density Shrub (class 22) (from 1998 satellite imagery)
BuffLcov	111	DevelLoDenSS150	% of the 100-150 ft zone classified as Developed Low Density Shrub (class 22) (from 1998 satellite imagery)
BuffLcov	112	DevelLoDenSS300	% of the 150-300 ft zone classified as Developed Low Density Shrub (class 22) (from 1998 satellite imagery)
BuffLcov	113	DevelLoDenSS50	% of the 0-50 ft zone classified as Developed Low Density Shrub (class 22) (from 1998 satellite imagery)
BuffLcov	114	ForestDecid100	% of the 50-100 ft zone classified as Deciduous Forest (class5) (from 1998 satellite imagery)
BuffLcov	115	ForestDecid150	% of the 100-150 ft zone classified as Deciduous Forest (class5) (from 1998 satellite imagery)

BuffLcov	116	ForestDecid300	% of the 150-300 ft zone classified as Deciduous Forest (class5) (from 1998 satellite imagery)
BuffLcov	117	ForestDecid50	% of the 0-50 ft zone classified as Deciduous Forest (class5) (from 1998 satellite imagery)
BuffLcov	118	ForestEvgr50	% of the 0-50 ft zone classified as Evergreen Forest (from 1998 satellite imagery)
BuffLcov	119	ForestEvgr100	% of the 50-100 ft zone classified as Evergreen Forest (from 1998 satellite imagery)
BuffLcov	120	ForestEvgr150	% of the 100-150 ft zone classified as Evergreen Forest (from 1998 satellite imagery)
BuffLcov	121	ForestEvgr300	% of the 150-300 ft zone classified as Evergreen Forest (from 1998 satellite imagery)
BuffLcov	122	ForestMix100	% of the 50-100 ft zone classified as Mixed Forest (class 7) (from 1998 satellite imagery)
BuffLcov	123	ForestMix150	% of the 100-150 ft zone classified as Mixed Forest (class 7) (from 1998 satellite imagery)
BuffLcov	124	ForestMix300	% of the 150-300 ft zone classified as Mixed Forest (class 7) (from 1998 satellite imagery)
BuffLcov	125	ForestMix50	% of the 0-50 ft zone classified as Mixed Forest (class 7) (from 1998 satellite imagery)
BuffLcov	126	ForestOpenSS100	% of the 50-100 ft zone classified as Open Forest Shrub (class 21) (from 1998 satellite imagery)
BuffLcov	127	ForestOpenSS150	% of the 100-150 ft zone classified as Open Forest Shrub (class 21) (from 1998 satellite imagery)
BuffLcov	128	ForestOpenSS300	% of the 150-300 ft zone classified as Open Forest Shrub (class 21) (from 1998 satellite imagery)
BuffLcov	129	ForestOpenSS50	% of the 0-50 ft zone classified as Open Forest Shrub (class 21) (from 1998 satellite imagery)
BuffLcov	130	GrassShort100	% of the 50-100 ft zone classified as Short Grass (class 28) (from 1998 satellite imagery)
BuffLcov	131	GrassShort150	% of the 100-150 ft zone classified as Short Grass (class 28) (from 1998 satellite imagery)
BuffLcov	132	GrassShort300	% of the 150-300 ft zone classified as Short Grass (class 28) (from 1998 satellite imagery)
BuffLcov	133	GrassShort50	% of the 0-50 ft zone classified as Short Grass (class 28) (from 1998 satellite imagery)
BuffLcov	134	GrassSparse100	% of the 50-100 ft zone classified as Sparse Grass (class 4) (from 1998 satellite imagery)
BuffLcov	135	GrassSparse150	% of the 100-150 ft zone classified as Sparse Grass (class 4) (from 1998 satellite imagery)
BuffLcov	136	GrassSparse300	% of the 150-300 ft zone classified as Sparse Grass (class 4) (from 1998 satellite imagery)
BuffLcov	137	GrassSparse50	% of the 0-50 ft zone classified as Sparse Grass (class 4) (from 1998 satellite imagery)
BuffLcov	138	GrassUrban100	% of the 50-100 ft zone classified as Urban Grass (class 25) (from 1998 satellite imagery)
BuffLcov	139	GrassUrban150	% of the 100-150 ft zone classified as Urban Grass (class 25) (from 1998 satellite imagery)
BuffLcov	140	GrassUrban300	% of the 150-300 ft zone classified as Urban Grass (class 25) (from 1998 satellite imagery)

BuffLcov	141	GrassUrban50	% of the 0-50 ft zone classified as Urban Grass (class 25) (from 1998 satellite imagery)
BuffLcov	142	RiparVeg50	% of the 0-50 ft zone classified as Riparian Vegetation (from 1998 satellite imagery)
BuffLcov	143	RiparVeg100	% of the 50-100 ft zone classified as Riparian Vegetation (from 1998 satellite imagery)
BuffLcov	144	RiparVeg150	% of the 100-150 ft zone classified as Riparian Vegetation (from 1998 satellite imagery)
BuffLcov	145	RiparVeg300	% of the 150-300 ft zone classified as Riparian Vegetation (from 1998 satellite imagery)
BuffLcov	146	RuralLawn100	% of the 50-100 ft zone classified as Rural Lawn (class 18) (from 1998 satellite imagery)
BuffLcov	147	RuralLawn150	% of the 100-150 ft zone classified as Rural Lawn (class 18) (from 1998 satellite imagery)
BuffLcov	148	RuralLawn300	% of the 150-300 ft zone classified as Rural Lawn (class 18) (from 1998 satellite imagery)
BuffLcov	149	RuralLawn50	% of the 0-50 ft zone classified as Rural Lawn (class 18) (from 1998 satellite imagery)
BuffLcov	150	ShrubAgMix100	% of the 50-100 ft zone classified as Mixed Shrubs & Agriculture (class 8) (from 1998 satellite imagery)
BuffLcov	151	ShrubAgMix150	% of the 100-150 ft zone classified as Mixed Shrubs & Agriculture (class 8) (from 1998 satellite imagery)
BuffLcov	152	ShrubAgMix300	% of the 150-300 ft zone classified as Mixed Shrubs & Agriculture (class 8) (from 1998 satellite imagery)
BuffLcov	153	ShrubAgMix50	% of the 0-50 ft zone classified as Mixed Shrubs & Agriculture (class 8) (from 1998 satellite imagery)
BuffLcov	154	ShrubEvgr50	% of the 0-50 ft zone classified as Evergreen Shrub (class 31) (from 1998 satellite imagery)
BuffLcov	155	ShrubEvgr100	% of the 50-100 ft zone classified as Evergreen Shrub (class 31) (from 1998 satellite imagery)
BuffLcov	156	ShrubEvgr150	% of the 100-150 ft zone classified as Evergreen Shrub (class 31) (from 1998 satellite imagery)
BuffLcov	157	ShrubEvgr300	% of the 150-300 ft zone classified as Evergreen Shrub (class 31) (from 1998 satellite imagery)
BuffLcov	158	ShrubForest100	% of the 50-100 ft zone classified as Deciduous Forest (class5) (from 1998 satellite imagery)
BuffLcov	159	ShrubForest150	% of the 100-150 ft zone classified as Deciduous Forest (class5) (from 1998 satellite imagery)
BuffLcov	160	ShrubForest300	% of the 150-300 ft zone classified as Deciduous Forest (class5) (from 1998 satellite imagery)
BuffLcov	161	ShrubForest50	% of the 0-50 ft zone classified as Deciduous Forest (class5) (from 1998 satellite imagery)
BuffLcov	162	ShrubGrass100	% of the 50-100 ft zone classified as Shrub/Grass (class 17) (from 1998 satellite imagery)
BuffLcov	163	ShrubGrass150	% of the 100-150 ft zone classified as Shrub/Grass (class 17) (from 1998 satellite imagery)
BuffLcov	164	ShrubGrass300	% of the 150-300 ft zone classified as Shrub/Grass (class 17) (from 1998 satellite imagery)
BuffLcov	165	ShrubGrass50	% of the 0-50 ft zone classified as Shrub/Grass (class 17) (from 1998 satellite imagery)

BuffLcov	166	ShrubUrban100	% of the 50-100 ft zone classified as Urban Shrub (class 26) (from 1998 satellite imagery)
BuffLcov	167	ShrubUrban150	% of the 100-150 ft zone classified as Urban Shrub (class 26) (from 1998 satellite imagery)
BuffLcov	168	ShrubUrban300	% of the 150-300 ft zone classified as Urban Shrub (class 26) (from 1998 satellite imagery)
BuffLcov	169	ShrubUrban50	% of the 0-50 ft zone classified as Urban Shrub (class 26) (from 1998 satellite imagery)
BuffLcov	170	WetEmEst100	% of the 50-100 ft zone classified as Emergent Estuarine Wetland (from 1998 satellite imagery)
BuffLcov	171	WetEmEst150	% of the 100-150 ft zone classified as Emergent Estuarine Wetland (from 1998 satellite imagery)
BuffLcov	172	WetEmEst300	% of the 150-300 ft zone classified as Emergent Estuarine Wetland (from 1998 satellite imagery)
BuffLcov	173	WetEmEst50	% of the 0-50 ft zone classified as Emergent Estuarine Wetland (from 1998 satellite imagery)
BuffLcov	174	WetEmForest100	% of the 50-100 ft zone classified as Marsh/ Forest (class 16) (from 1998 satellite imagery)
BuffLcov	175	WetEmForest150	% of the 100-150 ft zone classified as Marsh/ Forest (class 16) (from 1998 satellite imagery)
BuffLcov	176	WetEmForest300	% of the 150-300 ft zone classified as Marsh/ Forest (class 16) (from 1998 satellite imagery)
BuffLcov	177	WetEmForest50	% of the 0-50 ft zone classified as Marsh/ Forest (class 16) (from 1998 satellite imagery)
BuffLcov	178	WetEmNonEst100	% of the 50-100 ft zone classified as Emergent Non-estuarine Wetland (class 11) (from 1998 satellite imagery)
BuffLcov	179	WetEmNonEst150	% of the 100-150 ft zone classified as Emergent Non-estuarine Wetland (class 11) (from 1998 satellite imagery)
BuffLcov	180	WetEmNonEst300	% of the 150-300 ft zone classified as Emergent Non-estuarine Wetland (class 11) (from 1998 satellite imagery)
BuffLcov	181	WetEmNonEst50	% of the 0-50 ft zone classified as Emergent Non-estuarine Wetland (class 11) (from 1998 satellite imagery)
BuffLcov	182	WetEmSS100	% of the 50-100 ft zone classified as Deciduous Marsh/ Forest (class 20) (from 1998 satellite imagery)
BuffLcov	183	WetEmSS150	% of the 100-150 ft zone classified as Deciduous Marsh/ Forest (class 20) (from 1998 satellite imagery)
BuffLcov	184	WetEmSS300	% of the 150-300 ft zone classified as Deciduous Marsh/ Forest (class 20) (from 1998 satellite imagery)
BuffLcov	185	WetEmSS50	% of the 0-50 ft zone classified as Deciduous Marsh/ Forest (class 20) (from 1998 satellite imagery)
BuffLcov	186	WetForest100	% of the 50-100 ft zone classified as Wet Forest (class 9) (from 1998 satellite imagery)
BuffLcov	187	WetForest150	% of the 100-150 ft zone classified as Wet Forest (class 9) (from 1998 satellite imagery)
BuffLcov	188	WetForest300	% of the 150-300 ft zone classified as Wet Forest (class 9) (from 1998 satellite imagery)
BuffLcov	189	WetForest50	% of the 0-50 ft zone classified as Wet Forest (class 9) (from 1998 satellite imagery)
BuffLcov	190	WetShrub100	% of the 50-100 ft zone classified as Wet Shrub (class 10) (from 1998 satellite imagery)

BuffLcov	191	WetShrub150	% of the 100-150 ft zone classified as Wet Shrub (class 10) (from 1998 satellite imagery)
BuffLcov	192	WetShrub300	% of the 150-300 ft zone classified as Wet Shrub (class 10) (from 1998 satellite imagery)
BuffLcov	193	WetShrub50	% of the 0-50 ft zone classified as Wet Shrub (class 10) (from 1998 satellite imagery)
BuffLcov	194	ForestSSgrass50	% of the 0-50 ft zone classified as Forest Shrub & Grass (class 30) (from 1998 satellite imagery)
BuffLcov	195	ForestSSgrass150	% of the 50-100 ft zone classified as Forest Shrub & Grass (class 30) (from 1998 satellite imagery)
BuffLcov	196	ForestSSgrass100	% of the 100-150 ft zone classified as Forest Shrub & Grass (class 30) (from 1998 satellite imagery)
BuffLcov	197	ForestSSgrass300	% of the 150-300 ft zone classified as Forest Shrub & Grass (class 30) (from 1998 satellite imagery)
BuffLcov	198	Mowed50	% of the 0-50 ft zone classified as Mowed Field (class 3) (from 1998 satellite imagery)
BuffLcov	199	Mowed100	% of the 50-100 ft zone classified as Mowed Field (class 3) (from 1998 satellite imagery)
BuffLcov	200	Mowed150	% of the 100-150 ft zone classified as Mowed Field (class 3) (from 1998 satellite imagery)
BuffLcov	201	Mowed300	% of the 150-300 ft zone classified as Mowed Field (class 3) (from 1998 satellite imagery)
BuffLcov	202	DevelLoDenGrass300	% of the 50-100 ft zone classified as Low Density Developed with Grass (class 36) (from 1998 satellite imagery)
BuffLcov	203	DevelLoDenGrass100	% of the 100-150 ft zone classified as Low Density Developed with Grass (class 36) (from 1998 satellite imagery)
BuffLcov	204	DevelLoDenGrass150	% of the 150-300 ft zone classified as Low Density Developed with Grass (class 36) (from 1998 satellite imagery)
BuffLcov	205	DevelLoDenGrass50	% of the 0-50 ft zone classified as Low Density Developed with Grass (class 36) (from 1998 satellite imagery)
BuffGeneral	1	ID06	numerical identifier for composite wetland polygon, assigned in 2006
BuffGeneral	2	ID05	numerical identifier for composite wetland polygon, assigned in 2005
BuffGeneral	3	PtID	numerical identifier for sample point within the polygon (1= highest priority sample point/ polygon)
BuffGeneral	4	Visited	1= field data collected in 2005.
BuffGeneral	5	Acres50	Acres within the 0-50 ft buffer zone
BuffGeneral	6	Acres100	Acres within the 50-100 ft buffer zone
BuffGeneral	7	Acres150	Acres within the 100-150 ft buffer zone
BuffGeneral	8	Acres300	Acres within the 150-300 ft buffer zone
BuffGeneral	9	SoilDom50	Dominant mapped soil unit within the 0-50 ft buffer zone
BuffGeneral	10	SoilDom100	Dominant mapped soil unit within the 50-100 ft buffer zone
BuffGeneral	11	SoilDom150	Dominant mapped soil unit within the 100-150 ft buffer zone
BuffGeneral	12	SoilDom300	Dominant mapped soil unit within the 150-300 ft buffer zone
BuffGeneral	13	HydDNR50	Percent hydric soil (DNR) within the 0-50 ft buffer zone
BuffGeneral	14	HydDNR100	Percent hydric soil (DNR) within the 50-100 ft buffer zone
BuffGeneral	15	HydDNR150	Percent hydric soil (DNR) within the 100-150 ft buffer zone
BuffGeneral	16	HydDNR300	Percent hydric soil (DNR) within the 150-300 ft buffer zone
BuffGeneral	17	GWlo50	Aquifer rated as low-susceptibility; percent of the 0-50 ft buffer zone

BuffGeneral	18	GWlo100	Aquifer rated as low-susceptibility; percent of the 50-100 ft buffer zone
BuffGeneral	19	GWlo150	Aquifer rated as low-susceptibility; percent of the 100-150 ft buffer zone
BuffGeneral	20	GWlo300	Aquifer rated as low-susceptibility; percent of the 150-300 ft buffer zone
BuffGeneral	21	GWmid50	Aquifer rated as intermediate-susceptibility; percent of the 0-50 ft buffer zone
BuffGeneral	22	GWmid100	Aquifer rated as intermediate-susceptibility; percent of the 50-100 ft buffer zone
BuffGeneral	23	GWmid150	Aquifer rated as intermediate-susceptibility; percent of the 100-150 ft buffer zone
BuffGeneral	24	GWmid300	Aquifer rated as intermediate-susceptibility; percent of the 150-300 ft buffer zone
BuffGeneral	25	GWhi50	Aquifer rated as high-susceptibility; percent of the 0-50 ft buffer zone
BuffGeneral	26	GWhi100	Aquifer rated as high-susceptibility; percent of the 50-100 ft buffer zone
BuffGeneral	27	GWhi150	Aquifer rated as high-susceptibility; percent of the 100-150 ft buffer zone
BuffGeneral	28	GWhi300	Aquifer rated as high-susceptibility; percent of the 150-300 ft buffer zone
BuffGeneral	29	EAGLac	Acres of 0-300 ft buffer designated by WDFW as Bald Eagle habitat
BuffGeneral	30	SbirdAc	Acres of 0-300 ft buffer designated by WDFW as Shorebird Concentration Area
BuffGeneral	31	WfowlAc	Acres of 0-300 ft buffer designated by WDFW as Waterfowl Concentration Area
BuffGeneral	32	CnestDuckAc	Acres of 0-300 ft buffer designated by WDFW as Cavity-nesting Duck habitat
BuffGeneral	33	WduckAc	Acres of 0-300 ft buffer designated by WDFW as Wood Duck habitat
BuffGeneral	34	HDuckAc	Acres of 0-300 ft buffer designated by WDFW as Harlequin Duck habitat
BuffGeneral	35	WetlandNHPac	Acres of 0-300 ft buffer designated by WDFW as Wetland habitat
BuffGeneral	36	RiparNHPac	Acres of 0-300 ft buffer designated by WDFW as Riparian habitat
BuffGeneral	37	BTPIac	Acres of 0-300 ft buffer designated by WDFW as Band-tailed Pigeon habitat
BuffGeneral	38	MatureAc	Acres of 0-300 ft buffer designated by WDFW as Mature Forest habitat
BuffGeneral	39	Alt1_025	Type of alteration noted along a buffer transect within 25 ft of wetland: AGC,Crops, e.g. alfalfa AGP0,Pasture w. light grazing AGP1,Pasture w. unknown grazing AIR,Airstrip BARE,Plowed fields/ eroding banks/ dirt piles BDG0,Building not consistently occupied by people BDG1,Building consistently occupied by people BDOZ,Bulldozed/ graded BERM,Berm BURN,Burned CLR,Cleared. Mainly canopy removal. DICH,Ditched DIKE,Diked DOCK,Dock DRN,Drained usually w. subsurface tile EXC,Excavation including ponds FENC,Fence FILL,Fill FY0,Minor or long-ago forestry operation FY1,Logging FYGC,Forest ground-cover removal/ clearing FYPL,Reforestation/ tree farm GARD,Garden/ horticultural shrubs GPIT,Gravel pit

			HAYF,Hayfield LAWN,Lawn or yard MOW,Mowed field/ yard/ trail POND,Pond RD1,Major road/ highway/ parking lot RD2,Other road -- mostly paved RD3,Dirt road/ driveway RDGR,Gravel road/ driveway ROCK,Artificially place rock or other inorganic materia ROW,Right-of-Way for powerline or other utility TR,Trail UTIL,Power utility box
BuffGeneral	40	Alt2_025	Another type of alteration noted along a buffer transect within 25 ft of wetland
BuffGeneral	41	Alt3_025	Another type of alteration noted along a buffer transect within 25 ft of wetland
BuffGeneral	42	Alt4_025	Another type of alteration noted along a buffer transect within 25 ft of wetland
BuffGeneral	43	Slope_025	Slope measured on the field transect at 0-25 ft from the wetland
BuffGeneral	44	Bigtree_025	1= presence of big trees (>21" dbh) near the field transect at 0-25 ft from the wetland. Numbers >1 are the actual count, which was done inconsistently.
BuffGeneral	45	Bigsnag_025	1= presences of big snags (>20" dbh) near the field transect at 0-25 ft from the wetland
BuffGeneral	46	Biglog_025	1= presence of big logs (>12" diam. & >20 ft long) near the field transect at 0-25 ft from the wetland. Numbers >1 are the actual count, which was done inconsistently.
BuffGeneral	47	Nnsp_20_025	1= at least one non-native plant species comprises >20 percent cover along the 0-25ft transect
BuffGeneral	48	Imperv_025	Percent of the 0-25ft field transect that intercepted impervious surface
BuffGeneral	49	Bare_025	Percent of the 0-25ft field transect that intercepted bare surface that was bare due to shading)
BuffGeneral	50	Canopy_025	Percent of the 0-25ft field transect that was under a tree or shrub canopy
BuffGeneral	51	NatGcov_025	Percent of the 0-25ft field transect that intercepted areas containing natural herbaceous ground cover
BuffGeneral	52	Lawn_025	Percent of the 0-25ft field transect that intercepted managed ground cover (lawns, crops, etc.)
BuffGeneral	53	Watr_025	Percent of the 0-25ft field transect that intercepted water
BuffGeneral	54	Alt1_50	Type of alteration noted along a buffer transect within 25-50 ft of wetland
BuffGeneral	55	Alt2_50	Another type of alteration noted along a buffer transect within 25-50 ft of wetland
BuffGeneral	56	Alt3_50	Another type of alteration noted along a buffer transect within 25-50 ft of wetland
BuffGeneral	57	Slope_50	Slope measured on the field transect at 25-50 ft from the wetland
BuffGeneral	58	Bigtree_50	Count of big trees (>21" dbh) near the field transect at 25-50 ft from the wetland
BuffGeneral	59	Bigsnag_50	Count of big snags (>20" dbh) near the field transect at 25-50 ft from the wetland
BuffGeneral	60	Biglog_50	Count of big logs (>12" diam. & >20 ft long) near the field transect at 25-50 ft from the wetland
BuffGeneral	61	Nnsp_20_50	1= at least one non-native plant species comprises >20 percent cover along the 25-50ft transect

BuffGeneral	62	Imperv_50	Percent of the 25-50ft field transect that intercepted impervious surface
BuffGeneral	63	Bare_50	Percent of the 25-50ft field transect that intercepted bare surface (except due to shading)
BuffGeneral	64	Canopy_50	Percent of the 25-50ft field transect that intercepted bare surface due to shading
BuffGeneral	65	NatGcov_50	Percent of the 25-50ft field transect that intercepted areas containing natural herbaceous ground cover
BuffGeneral	66	Lawn_50	Percent of the 25-50ft field transect that intercepted managed ground cover (lawns, crops, etc.)
BuffGeneral	67	Watr_50	Percent of the 25-50ft field transect that intercepted water
BuffGeneral	68	Alt1_100	Type of alteration noted along a buffer transect within 50-100 ft of wetland
BuffGeneral	69	Alt2_100	Another type of alteration noted along a buffer transect within 50-100 ft of wetland
BuffGeneral	70	Alt3_100	Another type of alteration noted along a buffer transect within 50-100 ft of wetland
BuffGeneral	71	Slope_100	Slope measured on the field transect at 50-100 ft from the wetland
BuffGeneral	72	Bigtree_100	Count of big trees (>21" dbh) near the field transect at 50-100 ft from the wetland
BuffGeneral	73	Bigsnag_100	Count of big snags (>20" dbh) near the field transect at 50-100 ft from the wetland
BuffGeneral	74	Biglog_100	Count of big logs (>12" diam. & >20 ft long) near the field transect at 50-100 ft from the wetland
BuffGeneral	75	Nnsp_20__100	1= at least one non-native plant species comprises >20 percent cover along the 50-100ft transect
BuffGeneral	76	Imperv_100	Percent of the 50-100ft field transect that intercepted impervious surface
BuffGeneral	77	Bare_100	Percent of the 50-100ft field transect that intercepted bare surface (except due to shading)
BuffGeneral	78	Canopy_100	Percent of the 50-100ft field transect that intercepted bare surface due to shading
BuffGeneral	79	NatGcov_100	Percent of the 50-100ft field transect that intercepted areas containing natural herbaceous ground cover
BuffGeneral	80	Lawn_100	Percent of the 50-100ft field transect that intercepted managed ground cover (lawns, crops, etc.)
BuffGeneral	81	Watr_100	Percent of the 50-100ft field transect that intercepted water
BuffGeneral	82	Alt1_150	Type of alteration noted along a buffer transect within 100-150 ft of wetland
BuffGeneral	83	Alt2_150	Another type of alteration noted along a buffer transect within 100-150 ft of wetland
BuffGeneral	84	Alt3_150	Another type of alteration noted along a buffer transect within 100-150 ft of wetland
BuffGeneral	85	Slope_150	Slope measured on the field transect at 100-150 ft from the wetland
BuffGeneral	86	Bigtree_150	Count of big trees (>21" dbh) near the field transect at 100-150 ft from the wetland
BuffGeneral	87	Bigsnag_150	Count of big snags (>20" dbh) near the field transect at 100-150 ft from the wetland
BuffGeneral	88	Biglog_150	Count of big logs (>12" diam. & >20 ft long) near the field transect at 100-150 ft from the wetland
BuffGeneral	89	Nnsp_20__150	1= at least one non-native plant species comprises >20 percent cover along the 100-150ft transect
BuffGeneral	90	Imperv_150	Percent of the 100-150ft field transect that intercepted impervious surface

BuffGeneral	91	Bare_150	Percent of the 100-150ft field transect that intercepted bare surface (except due to shading)
BuffGeneral	92	Canopy_150	Percent of the 100-150ft field transect that intercepted bare surface due to shading
BuffGeneral	93	NatGcov_150	Percent of the 100-150ft field transect that intercepted areas containing natural herbaceous ground cover
BuffGeneral	94	Lawn_150	Percent of the 100-150ft field transect that intercepted managed ground cover (lawns, crops, etc.)
BuffGeneral	95	Watr_150	Percent of the 100-150ft field transect that intercepted water
BuffGeneral	96	WoodPct_025	Percent of the 0-25ft zone (not just transect) estimated in the field to contain a woody canopy
BuffGeneral	97	GrcovPct_025	Percent of the 0-25ft zone (not just transect) estimated in the field to **LACK** any live ground cover
BuffGeneral	98	NnatvPct_025	Percent of the 0-25ft zone (not just transect) estimated in the field to contain non-native plant species
BuffGeneral	99	NoxPct_025	Percent of the 0-25ft zone (not just transect) estimated in the field to contain plant species designated as "noxious"
BuffGeneral	100	WatPct_025	Percent of the 0-25ft zone (not just transect) estimated in the field to currently contain water
BuffGeneral	101	WoodPct_50	Percent of the 25-50ft zone (not just transect) estimated in the field to contain a woody canopy
BuffGeneral	102	GrcovPct_50	Percent of the 25-50ft zone (not just transect) estimated in the field to **LACK** ground cover
BuffGeneral	103	NnatvPct_50	Percent of the 25-50ft zone (not just transect) estimated in the field to contain non-native plant species
BuffGeneral	104	NoxspPct_50	Percent of the 25-50ft zone (not just transect) estimated in the field to contain plant species designated as "noxious"
BuffGeneral	105	WatPct_50	Percent of the 25-50ft zone (not just transect) estimated in the field to currently contain water
BuffGeneral	106	WoodPct_100	Percent of the 50-100ft zone (not just transect) estimated in the field to contain a woody canopy
BuffGeneral	107	GrcovPct_100	Percent of the 50-100ft zone (not just transect) estimated in the field to **LACK** ground cover
BuffGeneral	108	NnatvPct_100	Percent of the 50-100ft zone (not just transect) estimated in the field to contain non-native plant species
BuffGeneral	109	NoxspPct_100	Percent of the 50-100ft zone (not just transect) estimated in the field to contain plant species designated as "noxious"
BuffGeneral	110	WatPct_100	Percent of the 50-100ft zone (not just transect) estimated in the field to currently contain water
BuffGeneral	111	WoodPct_150	Percent of the 100-150ft zone (not just transect) estimated in the field to contain a woody canopy
BuffGeneral	112	GrcovPct_150	Percent of the 100-150ft zone (not just transect) estimated in the field to **LACK** ground cover
BuffGeneral	113	NnatvPct_150	Percent of the 100-150ft zone (not just transect) estimated in the field to contain non-native plant species
BuffGeneral	114	NoxspPct_150	Percent of the 100-150ft zone (not just transect) estimated in the field to contain plant species designated as "noxious"
BuffGeneral	115	WatPct_150	Percent of the 100-150ft zone (not just transect) estimated in the field to currently contain water
BuffGeneral	116	View25	Percent of off-transect 0-25ft buffer estimated to be viewable in the field
BuffGeneral	117	View50	Percent of off-transect 25-50ft buffer estimated to be viewable in the field

BuffGeneral	118	View100	Percent of off-transect 50-100 ft buffer estimated to be viewable in the field
BuffGeneral	119	View150	Percent of off-transect 100-150ft buffer estimated to be viewable in the field
BuffGeneral	120	SlopeAvg50	average slope in the 0-50 ft zone surrounding the wetland, from DEM data
BuffGeneral	121	SlopeAvg100	average slope in the 50-100 ft zone surrounding the wetland, from DEM data
BuffGeneral	122	SlopeAvg150	average slope in the 100-150 ft zone surrounding the wetland, from DEM data
BuffGeneral	123	SlopeAvg300	average slope in the 150-300 ft zone surrounding the wetland, from DEM data
BuffGeneral	124	SlopeMin50	minimum slope in the 0-50 ft zone surrounding the wetland, from DEM data
BuffGeneral	125	SlopeMin100	minimum slope in the 50-100 ft zone surrounding the wetland, from DEM data
BuffGeneral	126	SlopeMin150	minimum slope in the 100-150 ft zone surrounding the wetland, from DEM data
BuffGeneral	127	SlopeMin300	minimum slope in the 150-300 ft zone surrounding the wetland, from DEM data
BuffGeneral	128	SlopeMax50	maximum slope in the 0-50 ft zone surrounding the wetland, from DEM data
BuffGeneral	129	SlopeMax100	maximum slope in the 50-100 ft zone surrounding the wetland, from DEM data
BuffGeneral	130	SlopeMax150	maximum slope in the 100-150 ft zone surrounding the wetland, from DEM data
BuffGeneral	131	SlopeMax300	maximum slope in the 150-300 ft zone surrounding the wetland, from DEM data
BuffGeneral	132	Altout50	alterations noted within the 0-50 ft zone but off the transect
BuffGeneral	133	Altout100	alterations noted within the 50-100 ft zone but off the transect
BuffGeneral	134	Altout150	alterations noted within the 100-150 ft zone but off the transect
BuffGeneral	135	Altout300	alterations noted within the 150-300 ft zone but off the transect
BuffGeneral	136	BigTreeAny_0-100	Number of buffer zones in which any big trees were noted on the transect
BuffGeneral	137	BigSnagAny_0-100	Number of buffer zones in which any snags were noted on the transect
BuffGeneral	138	BigLogAny_0-100	Number of buffer zones in which any large logs were noted on the transect
BuffGeneral	139	NonNativeAny_0-100	Number of buffer zones in which any non-native plants with more than 20 percent cover were noted on the transect
LiDAR	1	ID06	numerical identifier for composite wetland polygon, assigned in 2006
LiDAR	2	A	Disturbance Present: Airstrip
LiDAR	3	B	Disturbance Present: Building
LiDAR	4	Be	Disturbance Present: Berm
LiDAR	5	C	Disturbance Present: Channel
LiDAR	6	Di	Disturbance Present: Ditch
LiDAR	7	Dr	Disturbance Present: Driveway
LiDAR	8	E	Disturbance Present: Excavation- other
LiDAR	9	F	Disturbance Present: Fence
LiDAR	10	Fd	Disturbance Present: Field
LiDAR	11	Fl	Disturbance Present: Fill
LiDAR	12	G	Disturbance Present: Grading
LiDAR	13	GP	Disturbance Present: Gravel Pit

LiDAR	14	GR	Disturbance Present: Gravel Road
LiDAR	15	P	Disturbance Present: Pond
LiDAR	16	Pk	Disturbance Present: Parking lot
LiDAR	17	PR	Disturbance Present: Paved Road
LiDAR	18	R	Disturbance Present: Road
LiDAR	19	Tr	Disturbance Present: Trail
LiDAR	20	Offsite	Disturbance was located outside of the wetland polygon
LiDAR	21	Extent of Geomorphic Disturbance	Percent of polygon occupied by geomorphic disturbance
LiDAR	22	Relative impact of linear Disturbance	A combination of disturbance type and extent: L= Low; M=Medium, H=High
LiDAR	23	Percent of polygon occupied by excav. Pond	Proportion of polygon occupied by excavated pond
LiDAR	24	Pond ?	P= Polygon is a pond. A "P" is given if polygon is >40% pond
LiDAR	25	Other disturbance: field/ veg removal	Proportion of polygon occupied by a disturbance in vegetation
LiDAR	26	DScore	Score for Geomorphic disturbances (10 means more disturbance)
LiDAR	27	Score including veg disturbance	Score based on Geomorphic disturbance and Vegetation disturbance
LiDAR	28	Relative certainty about disturbance	Degree of certainty about disturbance. L=Low; M=Medium, H=High
LiDAR	29	Topography:% flat	Approximate proportion of polygon that is flat
LiDAR	30	% Sloped	Approximate proportion of polygon that is sloped
LiDAR	31	Estimate of natural wetland area	% of polygon that appears to be undisturbed or "remnant" wetland. This column not filled in for all polygons examined
LiDAR	32	Map errror?	Description of the type of map error that occurs here that may effect the accuracy of the assessment of disturbances in the polygon
LiDAR	33	Recent change?	Change was apparent in the 2001 LiDAR but not in the 1998 aerial photo. Applies to the few types of disturbances that are clearly visible using both types of imagery
CORRPOS	1	Var1	Name of a variable (from this Data Dictionary)
CORRPOS	2	Gp1	Type of variable; codes beginning with F are field data; those beginning with D are from existing digital sources. DW= wetland data; DCAG= geomorphic data from the contributing area; DBZ= zoning data from the buffer zones; DBB= biological data from the buffer zones; DCALU= land use data from the contributing area; DCAZ= zoning data from the contributing area; DWLU= land use data from within the wetland; DWZ= zoning data from the wetland; DBLU= land use data from the buffer; DBG= geomorphic data from the buffer.zonesFWB= botanical data from the wetland; FB= data from the entire buffer; FBT= data from the buffer transect; FD= disturbance data from the wetland; FWQ= water quality data from in/near the wetland; FDOE= data from the WDOE Rating System; FA= animal observations from the wetland; FWBSP= species-level botanical data from the wetland; FW= geomorphic data from within the wetland; LID= LiDAR data; AP= airphoto data; PO= property ownership or contact data

CORRPOS	3	Var2	Name of a variable with which it showed a statistically significant and POSITIVE correlation
CORRPOS	4	Gp2	Type of variable; see Gp1 above
CORRPOS	5	Sign	P= positive association (as one variable increases, so does the other); N= negative association (as one increases, the other decreases)
CORRPOS	6	P-level	level of statistical significance of the correlation (smaller = more significant). The database excludes nonsignificant pairings, i.e., p>0.05
CORRPOS	7	R	Spearman rank correlation (larger = stronger relationship)
CORRPOS	8	N	number of records that were paired for these two variables
CORRNEG	1	Var1	Name of a variable (from this Data Dictionary)
CORRNEG	2	Gp1	Type of variable; see above
CORRNEG	3	Var2	Name of a variable with which it showed a statistically significant and NEGATIVE correlation
CORRNEG	4	Gp2	Type of variable; see Gp1 above
CORRNEG	5	Sign	P= positive association (as one variable increases, so does the other); N= negative association (as one increases, the other decreases)
CORRNEG	6	P-level	level of statistical significance of the correlation (smaller = more significant). The database excludes nonsignificant pairings, i.e., p>0.05
CORRNEG	7	R	Spearman rank correlation (larger = stronger relationship)
CORRNEG	8	N	number of records that were paired for these two variables
PERMITS05	1	ID06Wet	numerical identifier for composite wetland polygon, assigned in 2006
PERMITS05	2	PARCEL	parcel identification number used by ICPCD
PERMITS05	3	FILE	paper-file identification number used by ICPCD
PERMITS05	4	IC Category	category that reflects level of protection given to the wetland wtihin the parcek by the County's wetlands ordinance. A= highest, C= lowest.
PERMITS05	5	YEAR	Year the application was received
PERMITS05	6	DELINEATION	delineation of jurisdictional wetland boundary is in file: 1= yes; 0= no
PERMITS05	7	STAFF_NOTE	additional information available in paper file? 1= yes; 0= no
PERMITS05	8	Acres Wetland	acres of jurisdictional wetland within the specific parcel
PERMITS05	9	IDwet98	identification number used by ICPCD in their 1998 wetlands map
PERMITS05	10	REASONABLE USE	the result of legal determination of "reasonable use" (i.e., denial of application for wetland alteration would have resulted in no significant portion of the property being available for the planned use): 0= deemed not subject to "reasonable use" provision, 1= yes; 2= exempt
PERMITS05	11	ACTIVITY	Proposed activity: B= building, C= clearing, R= road, E= enhancement, U= utility
PERMITS05	12	Follow-thru	N= no action (permit issued without additional conditions); C= conditional approval; M= monitoring & restoration required; U= unknown
PERMITS05	13	Permit applied for before action?	0= no (after-the-fact permit issued); 1= yes (usual permit)
PERMITS05	14	Affected Area Sq Ft	total affected area in sq ft (usually, wetland + buffer)
PERMITS05	15	Buffer Impact Sq Ft	affected buffer area
PERMITS05	16	Wetland Impact Sq Ft	affected wetland area
PERMITS05	17	Other Files	identifiers of other County files associated with the parcel
PERMITS05	18	NOTES	further explanation of the permit application

APPENDIX C. PROCEDURES
Appendix C1. Sample Site Selection

The Selection Process

Island County's 958 mapped wetlands were assessed using a sample because (a) only a single field crew working a single field season was available to this project, (b) the crew could assess only 1-2 wetlands per day, and (c) many land owners were unwilling to allow the crew to access wetlands on private property. The sample wetlands to be visited were determined by using a generalized random-tessellation stratified (GRTS) design (Stevens 1997, Stevens and Olsen 1999, 2003, 2004). This approach generates a statistically random yet geographically balanced sample set of wetlands to be assessed. Use of geographic coordinates with GRTS allows the selection of points to achieve a relatively even spatial (geographic) distribution across the County's wetlands. With this method of selection, every polygon has the same probability of selection. This type of selection is appropriate for description of the wetland population in terms of *number* of polygons with particular properties, but not necessarily the total *area* of polygons with that property. The GRTS design has been used extensively in the USEPA's nationwide EMAP program, and is considered by many statisticians and scientists to be at the forefront of candidate statistical designs for unbiased regionwide and local monitoring programs. As part of this project, in collaboration with the ICPCD the primary author of the GRTS design – Dr. Donald Stevens – implemented its application to Island County wetlands as follows:

1. ICPCD staff used GIS to merge ("union") the existing wetland maps (ICPCD's and NWI's) to create "composite wetland polygons," but at first did not dissolve the boundaries of internal polygons that had resulted from the unions. The composite wetland polygons also included 211 of the 226 wetlands that had been delineated as part of permit applications to the ICPCD, and were not represented in their entirety in existing County and NWI wetland maps. Additional details on these data sources and the unioning process are provided in Appendix C4.

2. Using GIS, Dr. Stevens placed one point randomly within each of the polygons (including the undissolved internal polygons). This totalled 2557 (1958 non-estuarine, 366 estuarine, 233 derived from the ICPCD permit files and mostly forested non-estuarine). The entire list of polygons (estuarine and non-estuarine) then was arranged at random with GRTS using the random point coordinates as reference coordinates.

3. An identifier number was assigned to each of the 2557 points, representing the order in which it was randomly selected. The GRTS selection process reduced the likelihood of any two consecutively-numbered points (representing wetland polygons) being very near each other.

4. The 250 composite wetland polygons associated with the lowest-sequenced points were targeted for field sampling. Knowing that perhaps only 100 wetlands could be visited, we selected 250 to allow for anticipated denials for access permission from some property owners. In a few instances where a composite wetland polygon contained multiple points, the lowest-numbered point was used to represent that polygon in the selection process. Access requests to owners of the 250 polygons were then initiated. (see Appendix C2 for details).

Results

Despite denials of access permission from a sizeable proportion of property owners who were contacted, the 103 wetlands to which access permission was granted (and which ultimately we surveyed) appear to achieve the objectives of geographic balance and randomization (page 17). Furthermore, a Pearson's Chi-squared test verified that the proportional distribution of the visited wetlands was consistent with the distribution of the entire population of Island County wetlands. The representativeness of the sample was also evaluated by comparing the distribution of 131 wetland attributes on visited versus non-visited wetlands, using a statistical procedure described by Kincaid (2000) The 131 attributes were continuous variables with at least 25 records for both visited and non-visited wetlands. Of the 131 attributes tested, 49 (37%) were found to differ significantly ($p<0.05$) between the visited and non-visited wetlands. It is not uncommon for two populations to differ significantly with regard to this percentage of tested variables, even when pure statistical randomness is achieved in the selection of sites from the population.

Compared to non-visited wetlands, the visited wetlands tended to have:

- greater acreage (median= 8.85 acres vs. 2.46 for non-visited)
- larger contributing area (median= 112 acres vs. 42 for non-visited)
- more acres zoned as Rural (median= 2.41 acres vs. 0.78 for non-visited)
- less alteration to vegetation as interpreted from aerial image scoring (median= 0.13 vs. 0.35)
- less flat area within the wetland (median= 68% occupied by slope vs. 84% in non-visited)
- more Developed Low Density land cover in the 50-100 ft (median= 2.98 vs. 2.26%) and 100-150 ft surrounding zones (median = 2.74 vs. 2.70%)
- greater average slope in the 100-150 ft zone (8.22 vs. 6.82%) and the 150-300 ft zone (8.48 vs. 7.21%)
- greater maximum slope in all the surrounding zones
- greater maximum slope in the contributing area (median= 48% slope vs. 37%)

References

Kincaid, T.M. 2000. Testing for differences between cumulative distribution functions from complex environmental sampling surveys. In 2000 Proceedings of the Section on Statistics and the Environment, American Statistical Association, Alexandria, VA.

Stevens, D.L., Jr. 1997. Variable density grid-based sampling designs for continuous spatial populations. Environmetrics 8: 167-195

Stevens, D.L., Jr., and Olsen, A.R. 1999. Spatially restricted surveys over time for aquatic resources. Journal of Agricultural, Biological, and Environmental Statistics 4: 415-428

Stevens, D.L., Jr., and Olsen, A.R. 2003. Variance estimation for spatially balanced samples of environmental resources. Environmetrics 14: 593-610.

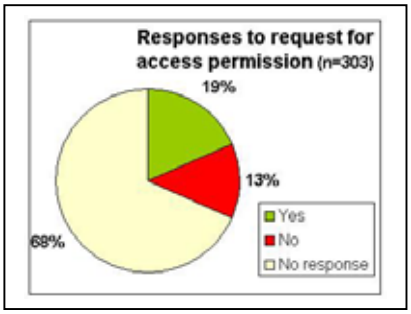
Stevens, D.L., Jr., and Olsen, A.R. 2004. Spatially balanced sampling of natural resources. Journal of American Statistical Association 99: 262-278

Appendix C2. Land Owner Contacts

Contact Procedures

Of the 958 wetlands mapped in Island County, 284 were chosen for field assessments using a geographically-balanced selection algorithm (see Appendix C1). The County contacted the landowners of properties surrounding each of these wetlands requesting access to survey their wetland and adjacent upland study area.

With an initial goal to gain unrestricted access to the perimeter of as many wetlands in the County as possible, letters were initially sent to property owners surrounding 150 wetlands, the first 150 wetland on the list described in Appendix C1. Due to a slow return of access approvals, the County followed up with a second mailing to property owners surrounding the next 134 wetlands on the list. In total, approximately 2,100 letters were mailed to property owners surrounding the 284 wetlands. The letter explained the goals of the study and its legislative context while promising to respect the landowner's privacy. Finally, the letter requested access to the property and asked the property owner to return a pre-addressed stamped postcard indicating if he/she granted or denied access and if they would like to be present during the survey.



Property Owner Database

Because the County does not have a complete digital parcel layer, there is no capacity to spatially overlay selected wetlands with individual parcels. Therefore, identification of individual parcels including contact addresses for properties surrounding all 284 wetlands was a labor-intensive task. Multiple data sources were used to compile addresses of all properties within a 300-foot study area surrounding the perimeter of the 284 wetlands identified for sampling. The number of lots surrounding individual wetlands varied; in some cases a wetland lay completely with an individual lot, in other cases a wetland was surrounded by hundreds of individual lots. As previously stated, of the 284 wetlands prioritized for sampling, more than 2100 property owners were contacted. Despite the lack of a coordinated spatial database with property-owner information, the County database of addresses is accurate: of the 2100+ letters mailed out, only 26 letters were returned for which no current contact address was obtained.

Property Access

To complete the necessary components of the wetland survey, the majority of the perimeter of the wetland had to be accessed. This often required permissions from multiple property owners and coordination in setting up an agreeable date and time for the field crew to visit the site. Many property owners had specific questions on potential regulatory impacts of allowing access to their property, so the County's response to these concerns required a large amount of time, but was viewed as supremely important to the integrity of the project. As the field season progressed, the field crew was able to start analyzing the sufficiency of partial access situations for collecting data. If access was denied to a majority of the wetland, or obvious physical characteristics of wetlands could not be accessed, then time resources were diverted to other wetlands further down the priority list.

In situations where completion of the survey required access to only one or two additional lots, County staff would ‘cold call’ the property owner offering to respond to any questions/concerns they might have as well as providing further explanation about the goals of the project.

Appendix C3. Field Procedures

For each visited wetland three forms were filled out:

1) the data form from WDOE's *Western Washington Wetlands Rating System* (Hruby 2004)
2) a data form (the ICPCD Wetland Form) designed by Paul Adamus specifically for Island County conditions, and for the purpose of supplementing the list of WDOE variables with others of potential use for assessing wetland health (Table C3.2)
3) a data form (the ICPCD Buffer Form) designed by Paul Adamus for assessing conditions in zones surrounding each wetland (Table C3.3)

Table C3.1 below contains the field protocol, written by Paul Adamus and provided to the crew at the beginning of the season. Bracketed "*Comments*" sections have been added to describe how the protocol was implemented. During the field season, a limited number of modifications and clarifications of that protocol were made by the field crew in consultation with Dr. Adamus, as rarely dictated by unusual circumstances encountered in some wetlands. Those changes are reflected in Table C3.1.

Table C3.1. Protocol for the ICPCD Wetland Site Visits in 2005

Arriving On Site:

1. Bring the following with you each day, in addition to field equipment: a 1998 aerial photograph of the wetland, 2001 LiDAR hillshade image, a soil map, and copies of property-owner access permission slips as well as parcel maps from the County's "Real Property" database. Talk with landowner if pre-arranged. *[Comment: Of the landowners that granted permission to access their land, most wanted to be present during the field-visit, and often several landowners surrounding one wetland wanted to be present. Times needed to be arranged that would be convenient to everyone, which often meant scheduling one part of the wetland in the morning and the other in the afternoon].*
2. Use topo map and parcel map to navigate to the wetland sample point. Use the GPS to confirm you're in exactly the correct location. *[Comment: As expected, physically accessing some of the wetlands was challenging. Many wetlands consisted of dense brush, dense forest with much downed wood, or high water, so simply getting to enough of the wetland to be able to answer all of the questions on the data forms was time-consuming. Some of the questions on the data forms, such as locating the outlet of the wetland, required exploring the whole wetland- a time consuming task.]*
3. If the sample point qualifies as wetland, proceed to #7. If not, but you see an adjoining area on the same property that does, move the sample point there and proceed to #7. If no area qualifying as wetland is obvious, search more intensively in a radius of 100 ft around the sample point (but still on property to which you have access) until you find one. If you're still unsuccessful in finding any wetland, or it is not located where previously mapped, assess the area anyway and note that no wetland was found.

Assessing the Wetland:

4. Sketch the approximate boundary of the wetland assessment area on the grid map. If a formal delineation has already been done on this site, use that as guidance. *[Comment: The GIS-polygon boundary from the aerial photo or LiDAR was used to trace an outline. The purpose of this sketch map was to determine approximate percent cover of the different vegetation strata and hydroperiods, as well as to note where soil samples and photographs were taken. Where mapping errors were great, the map gives an indication of the location of the actual wetland compared to the mapped wetland. The maps are* ***not*** *intended to be official delineations of the wetland boundary and do not constitute a legal wetland delineation.]*
5. Identify plants within the wetland. Identify only the plants (upland or wetland species) that:
    (a) are within an area dominated by plants that are wetland indicators (see list), and
    (b) cover a cumulative area of at least 9 sq.ft.

[Comment: Late in the field season (September-November), species that covered less than 9 sq. ft also were recorded. At that time, when even one specimen of a plant was found it was recorded, assuming that other individuals had been present but were just unrecognizable at that time.]

Photograph (with a label) any unknown species that meet the above criteria, and also bag them for keying out later in the day. Stop searching for new plant species:
    (a) once you find 20 species (excluding noxious ones) that meet both the above criteria, or
    (b) you both believe you've searched all accessible parts of the wetland.

6. Dig at least 2 soil pits, each 12 inches deep. Dig one in an area that appears most strongly to be a wetland (but not where flooded) and the other near what appears to be the wetland-upland edge. Additional pits may be dug in areas that appear to have a different a vegetation community, elevation, and/or hydrologic regime. Identify the soil chroma and value in each soil horizon using a Munsel soil chart, record that along with the soil texture and presence/absence of redox indicators (mottling,

gleying, or oxidized rhizospheres). Note the depth of each transition in color and/or texture. Dig an upland soil pit and record the same data for comparison with the wetland soils.
7. Fill out the *ICPCD Wetland Form* as well as the *WDOE Wetland Rating Form*.
8. From a vantage point that provides the most complete view of the site, shoot a panoramic series of photos. Include the whiteboard in the first shot in the series, with the date, compass direction, and site code shown. Mark the photo location on the sketch map. GPS the photo point if a sufficient signal can be obtained.
9. If surface water is present within the wetland, measure specific conductance with the handheld conductivity meter and record this on the *ICPCD Wetland Form*. *[Comment: Consideration was given to also measuring pH, but this was not done because pH in wetlands often shows extreme diurnal variation].*
10. Assess the wetland buffer as follows:

9.1 From the map, note where the random point has been placed in the wetland. Then lay out a measuring tape in a 150-ft line (transect) perpendicular to the wetland-upland edge and extending away from the wetland. Keep it within the property you were given permission to access. Define the wetland-upland edge as precisely as you can using vegetation and soil indicators. GPS the transect starting and ending points if possible. [*Comment: If the random point was located in a part of the wetland to which no access was granted, the transect was started at a part of the wetland-upland edge closest to that point on property that we did have access to. For estuarine wetlands, if the random point was in marine waters, the transect was taken from the upland side of the wetland closest to that point.]*

9.2 At observation points located at 25, 50, 100, 200, and 300 ft on each transect, fill out the *ICPCD Buffer Form* based on what you observe behind you and approximately 50 ft to the right and left. Photograph any significant disturbances you note that would not be obvious from aerial photographs, e.g., downcut streams.

9.4 If major shifts in land cover or slope occur partway between 2 points along any transect, measure the exact distances where the shifts occur.

10. Check data forms for completeness, thank the landowner, and proceed to next wetland on list.
[Comment: In most visits the field technicians consulted each other continually throughout the visit in order to ensure greater objectivity and throughness in the responses.]

Table C3.2 ICPCD Wetland Data Form

Polygon #: _____ Point #s:_____ Site Name:_____
Target Coordinates:_____ Actual Coordinates:_____
Polygon Area (from file):_____acres Assessor: _____
Date: _____ Begin Time: _____a.m. p.m.
Polygon area to which access permission was granted: _____acres _____% of polygon
Polygon wetland-upland edge to which access permission was granted: _____ft _____% of edge

1. Observed Alterations

For each item in the list below, assess its extent *within the wetland* (not in the buffer):
Area Extent: **L**= covers <1% of wetland, **LM**= 1-10%, **M**= 11-50%, **H**= >50%, (blank)= none,
Time: **C**= current/ ongoing, **RP**= recent past (1-20 yrs ago), **DP** = distant past (more than 20 yrs ago)
If landowner is willing to participate, ask for the exact year (most recent and/or extensive, post-1984).
Circle any information that came *only* from the landowner (not from your observations or County files).

Alterations (Ask landowner. Note that most ARE legal)	**Code**	**Estimated Extent(s) and Time(s)***
Burning (brush, grass, campfire, etc. – look for tree or soil scarring)	B	
Channel or channel bank reconfiguration	CH	
Ditching (i.e., new drainage channel)	DI	
Excavation (other than ditching)	X	
Fence (functional)	F	
Fertilizer or pesticide application	FP	
Grazing by livestock (cowpies, hoof tracks, etc.)	G	
Installation of subsurface drains	DR	
Installation of well	W	
Mowing	M	
Placement of a dam or berm, with water control outlet	DMC	
Placement of a dam or berm, without water control outlet	DM	
Placement of dike, levee, or lateral berm	DK	
Plantings – crops	CR	
Plantings – horticultural shrubs/ trees	HS	
Plantings – reforestation	FP	
Plantings – lawn or pasture (i.e., graminoids)	LP	
Plantings – other (specify):	P	
Soil placement (fill) or grading	S	
Riprap	RR	
Road or driveway	RD	
Sediment/ erosion control barriers (hay bales, curtains, logs installed intentionally for this purpose)	SB	
Soil Ripping	SR	
Soil Tillage	ST	
Stormwater pipe or diversion ditch input	SW	
Subsurface soil drainage (drain pipes or tile)	SD	
Trails, maintained or not	TR	
Trash piles (excluding compost)	TP	
Tree/ shrub Cutting (logging)– timber harvesting, thinning, firewood removal	LOG	
Tree/ shrub Cutting or Trimming – for trails or rights-of-way	ROW	
Tree/ shrub Cutting – other (specify):		
Vehicle tracks	V	
Water removal (e.g., pumping for irrigation of non-wetland area)	WR	

2. Major habitat types within wetland, by area.
These may overlap and do not necessarily sum to 100%. Do not include deepwater areas (>6.6 ft deep)
____% Trees/ Shrubs _____% Emergents ___% Aquatic Bed ___ % Moss
____% Water, permanent ___ % Bare mud/ sand/ rock

Non-native Emergents, as % of all emergent cover: _____
Non-native Woody, as % of all woody cover: _____
Non-native Aquatic Bed, as % of all aquatic bed cover: _____

3. Land cover on the wetland edge, viewed from above. These must *contact* the wetland boundary. They sum to 100%:

___% artificial impervious (roads, buildings, etc.)
___% bare sand, rock, soil
___% tree & shrub
___% grass/forb/moss, uncultivated or pasture
___% grass/forb, cultivated (crop, lawn, etc.)
___% open water
100%

4. Signs of possible damage. If uncertain, photograph and describe these for later diagnosis.
___Unnaturally incised (entrenched) channel
___Hydrophytes with unnaturally discolored foliage
___Sediment or oil coatings on foliage
___Massive growths of aquatic algae
___Unnatural water or sediment color or odor
___Greatly elevated water marks despite small contributing area
___Extensive mud, suggesting recent sudden drawdown or drainage (non-tidal wetlands)
___Extensive blowdown/ windthrow of trees, i.e., majority of trees within polygon
___Soils difficult to penetrate

5. Inhabited structure, estimated distance from wetland to nearest
___ year-round residence __seasonal residence ___school
___ commercial/ industrial/ office ___barn ___other:_____

6. Indicate height of **water marks** above today's wetted edge, if any found:

	in channel	outside channel
Type of indicator*		
Maximum height above today's wetted edge		

*Debris, Stain, Ice abrasion, Algae. Non-tidal wetlands only.

7. Estimate the **maximum depth** of surface water (<6 ft deep) as it would exist:

	During wettest 2 weeks annually	During driest 2 weeks annually
Standing water		
Flowing water		

* do so by considering the basin or channel morphology, elevation, contributing area, and today's water depth

8. Percent of polygon that is:

(for non-tidal wetlands):

Inundated continuously *only* for 2-4 weeks per year _____%
Inundated longer but not continuously year-round* _____%
Inundated year-round without interruption* _____%
Almost never, but soil is saturated for >2 weeks/yr _____%
100 %

* estimate area (m^2) of the zone only if it occupies <100 m^2

(for tidal wetlands):

Floods and drains twice daily from the tide _____%
Floods by the tide but outflow is strongly impeded _____%
Flood by the tide only seasonally _____%
100 %

9. Percent of the water surface (permanent flowing or standing) that would be **shaded** by topography or vegetation at mid-day: _____%

10. Water measurements (non-tidal sites only):

Specific conductance: _____

11. Soil pits. Pits should be dug in each soil polygon mapped as present in the wetland. If the wetland contains only one mapped soil type, place the pits as far apart as possible within the wetland.

Pit #1 (upland)

	Value & chroma	Redox indicators:	Texture	Veg Species (1-2 dominant)
0 to _____				
_____ to _____				
_____ to _____				

Pit #2 (wetland)

	Value & chroma	Redox indicators:	Texture	Veg Species (1-2 dominant)
0 to _____				
_____ to _____				
_____ to _____				

Pit #3 (wetland)

	Value & chroma	Redox indicators:	Texture	Veg Species (1-2 dominant)
0 to _____				
_____ to _____				
_____ to _____				

Pit #4 (wetland)

	Value & chroma	Redox indicators:	Texture	Veg Species (1-2 dominant)
0 to _____				
_____ to _____				
_____ to _____				

12. Were any of the following **animals** detected during this visit?
(mark "X" if IN wetland, "E" if external, and "B" if evidence of breeding (e.g., fledglings or nest noted)

__ Toad (larvae or adults)	__Turtle (any sp.)	__Salamander/ Newt (any sp.)
__Pileated Woodpecker	__Dragonfly adult	__Osprey
__Great Blue Heron	__Sandpiper/ Plover/ Snipe/ Rail	__Bald Eagle
__bats	__Band-tailed Pigeon	__Beaver (incl. cuttings)
Ducks/Geese (species if known):		
Any wild mammal not listed above (excluding deer):		

13. Plants Found *in Wetland*. List only if they cover 9 m^2. Use the standard codes. ***Circle*** all dominants *within each stratum* (50-20 rule). Photograph any species not previously photographed, plus uncertain species.

Emergents (incl. vines)	Shrubs (woody <20')	Trees (woody >20')	Aquatic Bed

Table C3.3. ICPCD Buffer Data Form

Associated Polygon #: _____ Point #s:_____
Assessor: _____ Date: _____ Begin Time: _____a.m. p.m.

Do one 150'ft transect, beginning closest to the lowest-numbered GRTS point and running generally perpendicular to the wetland-upland edge, and record what you observe within 50 ft (sideways) of the transect, as follows:

GPS coordinates (start):_____ GPS (end):_____ Bearing from wetland:_____

		zone:	0-25 ft	25-50 ft	50-100 ft	100-150 ft
		Alterations (list all):				
		Slope %				
		Trees >21" dbh				
		Snags >20" dbh				
		Logs, large (>12" diam & >20 ft long)				
		Non-native species (circle if >20% cover)				
Buffer Cover (do <u>not</u> necessarily sum to 100%)		% artificial impervious				
		% bare due to natural factors*				
		% tree or shrub canopy				
		% natural ground cover (live)				
		% crops/ lawn				
		% water or wetland				
Transition:		Type*:_____ distance:				
Transition:		Type: _____ distance:				
Transition:		Type: _____ distance:				
Transition:		Type: _____ distance:				
Transition:		Type: _____ distance:				
Transition:		Type: _____ distance:				

**[Comment: Values recorded in the beginning of the field season may be overestimates for this category since "bare ground" was taken to mean any bare ground not covered by moss or groundcover. It was later clarified as bare ground under tree canopy with little/no shrubs below eye level and minimal duff protecting soil surface.]*

<u>Transition types:</u>
WNW = within the zone, a shift or gap occurs between Woody and Non-woody (emergent) vegetation
CUC = between Cultivated and Uncultivated vegetation
IM = between artificial Impervious surface and any other category
NC = the transect crosses into an area whose surface runoff doesn't contribute to this wetland (NC) (e.g., backside of a ridge)

2. Overall buffer conditions (excluding water areas). Walk completely around the wetland at a distance of about 100 ft. uphill from the wetland-upland edge and assess the following:

zone	0-25 ft	25-50 ft	50-100 ft	100-150 ft
% containing a woody canopy				
% lacking any live ground cover				
% containing non-native vegetation				
% containing noxious species				

3. Measure distance to any additional alterations not intercepted by the transect:

Type of Alteration	Distance	How Recent?*

*** C**= current/ ongoing, **RP**= recent past (1-20 yrs ago), **DP** = distant past (more than 20 yrs ago)

4. Other signs of possible damage to the buffer. If uncertain, photograph for later diagnosis.

___Fresh gullies, rills, or channel headcutting (estimate length: _____)
___Unnaturally incised or undercut channel
___Unnaturally discolored foliage
___Sediment or oil coatings on foliage
___Slides, mudflows, mass wasting
___Extensive blowdown/ windthrow of trees (majority of buffer area)

5. Percent of buffer zones that could <u>not</u> be viewed sufficiently (due to property constraints, dense veg, or topography):

zone	0-25 ft	25-50 ft	50-100 ft	100-150 ft
Unviewable %				

Appendix C4. Spatial Data (GIS) Procedures

The GIS component was a key aspect of this project. Several necessary tasks identified by Dr. Adamus were accomplished by ICPCD staff using GIS:

1. Wetland delineations in paper files of the ICPCD were digitized.
2. Multiple existing versions of Island County wetland locations and boundaries (maps) were digitally combined into one, and a uniform numbering system applied.
3. Wetland contributing areas and wetland surrounding areas (including buffers) were digitally delineated.
4. A sample of the digitally-derived wetland contributing areas was field checked to estimate the precision of the boundaries.
5. Wetlands were dynamically segmented, that is, surface and possible groundwater connections among wetlands, and wetlands and streams, were defined and catalogued in the geodatabase.
6. Spatial data sets with various themes were identified, obtained, converted to a common projection and scale, and overlaid with wetland maps to extract hundreds of possible attributes for each wetland, contributing area, and surrounding area zones. These data were organized into a geodatabase. In the future, for any wetland for which some management or regulatory action is contemplated, ICPCD staff can quickly extract from the geodatabase a plethora of biological and geomorphic characteristics of the wetland and its surroundings that are useful to decisionmaking. Linkage is also made to paper files at ICPCD that describe past permit decisions that involved the wetland. All the extracted variables are listed in Appendix B.

Details of the above-listed GIS procedures have been documented intricately and with many illustrations in an internal ICPCD document available electronically upon request.

The primary data themes for which data on variables were compiled, at least for the subset of wetlands, contributing areas, and surroundings where such data were available are:

- Acreage
- Wetland class(es) (HGM, Cowardin)
- Wetland category (WDOE, Island County)
- Zoning designation(s)
- Land cover (from 1992 and 1998 satellite imagery)
- Soil type(s), including designations for hydric, peat, and general textures
- Slope, elevation, annual precipitation, and several hydrologic-topographic indices
- Aquifers designated as high, moderate, and low susceptibility to pollution
- Critical Drainage Areas (County-designated), where recent and future growth is most likely
- Length of internal streams and roads, by type
- Presence of species & habitats recognized by WDNR's Washington Natural Heritage Program
- Post-1996 timber harvests documented by the WDNR
- Field data collected during summer 2005, including dominant plants, soils, geomorphic attributes, and disturbances (see Appendix C3)
- Water quality data from nearby wells and surface waters (very limited)
- Disturbances to the wetland noticed in 2001 LiDAR imagery (extent, type) (see Appendix C5)
- Change in condition of the wetland and its surroundings from 1985-1998, and 1998-2005 (extent, type) (see Appendix C6)

The specific data sources and metadata associated with the above are described in Appendix C8.

Two additional data sets were compiled but not used. One consisted of a statistically-random, geographically-balanced series of 1000 non-wetland points throughout Island County, and a subset of this consisting of 500 random points located in just the polygons mapped as having hydric soil but which do not contain wetlands according to the County's new composite wetland polygon map. It is envisioned that both sets of random points, along with those placed in wetlands using the same GRTS selection algorithm (see Appendix C1) could be used to spatially model and predict the probability-of-occurrence of unmapped wetlands throughout Island County.

Appendix C5. Assessing Disturbances to Wetlands Using LiDAR

LiDAR, or Light Detection And Ranging, is a technology that detects the topography of the ground surface from an aircraft. Information from LiDAR returns had previously been used to create a "bare earth" DEM (Digital Elevation Model) that is a representation of the earth's surface where all man-made structures and vegetation have been removed. LiDAR has a vertical accuracy of about a foot so can detect geomorphic disturbances such as ditches, areas of excavation, or fill which are less detectable in aerial photos or satellite images. The LiDAR bare earth DEM (referred to simply as LiDAR in this report) is comparable to the USGS Digital Elevation Models, but is of much higher accuracy and resolution (6 foot horizontal resolution compared to 30 foot), thus detecting more detail on the landscape. An added advantage of the LiDAR is that it was produced in 2001 and so provides a more recent picture of the landscape than some of the aerial photographs. In this part of the study, LiDAR was used in combination with several other GIS data layers to detect possible geomorphic disturbances in the wetlands across Island County.

There was no previously known protocol for using LiDAR data to assess the extent of disturbance to wetlands. For this project, a protocol was developed that would be appropriate for the wetlands of Island County. First, information obtained about the 103 wetlands that were examined in detail during field visits between July and November 2005 was re-examined. Features that appeared to be disturbances in the LiDAR and aerial photos were verified/rejected as disturbances based on the field data. Another 590 wetland polygons were examined and a "disturbance score" was assigned to each polygon. Because alterations to estuarine wetlands are usually quite visible in aerial photographs, LiDAR assessments were done only of non-estuarine wetlands. Because time did not allow assessment of all non-estuarine wetlands, wetlands were methodically examined beginning with the wetland with the lowest PointID and proceeding in ascending order with the first 50 polygons in every group of 100 (e.g., 1-50, 100-150, etc.). This provided a spatially-balanced random sample. Overall, 75% of the non-estuarine wetlands in Island County were examined.

The following describes generally the procedures used. An electronic file containing a series of images that demonstrate and document how interpretations of disturbances were made is available by request from the ICPCD.

Data Acquisition and Analysis

Every wetland polygon was assigned a score in each of the data categories that are explained below.

1) Types of disturbance present

The primary focus of this analysis was to detect geomorphic disturbances that would be more visible in the LiDAR than in aerial photos. Therefore, mostly "linear" disturbances, which are easily discernible from natural features, were identified. These types of disturbances include ditches, roads, fences and excavations. Major disturbances that were more visible with the aerial photos (such as buildings and clearings) were also noted. Disturbances were listed as one of the following types: Road; Paved Road; Gravel Road; Gravel Pit; Building; Berm; Pond; Ditch/channel; Driveway; Dike, Fenceline; Field; Fill; Clearing; Grading; Parking lot; Trail; Excavation-other; Airstrip.

2) General location of each disturbance: The general location of each disturbance was noted and then written down as either: Edge of polygon (E), Bisecting polygon (B), Center of polygon (C), or Throughout polygon (T).

3) Extent of geomorphic disturbances: To assess the overall extent of the geomorphic disturbance, a category was created for percent of polygon affected by all of the geomorphic disturbances combined. The area affected by the disturbance was compared to the area of the entire polygon, and percent of polygon affected was determined.

4) Score: The scoring ranged from 0 to 10, with 0 being no disturbance, 1 being some disturbance and 10 being highly disturbed. This score was based primarily on direct alterations of the soil and hydrology (geomorphic disturbances) and is a synthesis of Type of Disturbance, general Location of Disturbance and Extent of Disturbance. A disturbance affecting 10% of the area would always receive a score of at least 1. The type and location of the disturbance would increase the score from there. For instance, a paved road affecting 10% of the area would receive a higher score than a fence affecting 10% of the area, and a paved road through the middle of the polygon received a higher score than a paved road on the edge of the polygon. As another example, a ditch that impacts about 10% of the polygon and is located near the edge of the polygon received a score of 1. If the disturbance is a road and bisects the polygon (though still only affecting about 10% of the total area) the polygon received a score of 2. If 50% of a polygon was affected by ditching the polygon would receive a score of 5, but if 50% of the polygon was affected by ditches and roads it received a score of 6. The highest scores (9-10) could only be attained if the entire area was affected by a combination of major geomorphic disturbances.

Examples of scoring: Geomorphic disturbances

Wetland ID	Type of Disturbance	Location	Extent of Geomorphic Disturbances	Score
7	Ditch	Edge	10%	1
8	Road	Bisects	10%	2
10	Fence	Bisects	10%	1
13	Ditches	Throughout	50%	5
24	Ditches	Throughout		
	Roads	Throughout	50%	6
33	Paved Roads	Throughout		
	Grading	Throughout		
	Buildings	Center		
	Ditches	Throughout	100%	10

5) Extent of vegetation disturbances:
This category accounts for alterations not of the earth, but to the vegetation. It was feasible to detect these disturbances in aerial photographs taken in 1998, but not in the LiDAR imagery from 2001. The kinds of disturbances included logged sections of forest, yards surrounding houses, and fields. The percent of the polygon where trees/shrubs were removed was recorded. Areas that appeared to be naturally devoid of shrubs and trees (such as ponded areas or wetlands along the coastline) were not noted in this category.

6) Score including vegetation disturbance:
This score was determined based on a combination of the geomorphic disturbance score and the percent of the polygon with a vegetation disturbance. Vegetation disturbance only increased the score of a wetland; that is, no vegetation score is lower than the geomorphic disturbance score. Since this score includes both geomorphic disturbance and vegetation disturbance, a polygon can't receive a score of 10 for vegetation disturbance alone; linear disturbances need to occur as well to give a disturbance score this high. As a rule, a polygon for which 100% of the area had significant vegetation disturbance (i.e., the polygon was obviously a mowed-field) received a score of 5. Any additional geomorphic disturbance would increase the score.

For example, if the polygon had a score of 2 for geomorphic disturbance, and the polygon was 100% field, it would receive a score of 6. Geomorphic disturbance scores and vegetation disturbance percentages were not necessarily summed, or an entirely cleared area with a geomorphic disturbance score of 7 would be off the 10-scale. An area that already got a very high score for geomorphic disturbance did not get much of an increase in score from vegetation disturbance.

Examples of scoring: Vegetation Disturbances + Geomorphic disturbances

Wetland ID	Geomorphic Disturbance Score	Percent Vegetation disturbance	Score including Vegetation disturbance
3	1	10%	1
6	0	100%	5
12	2	100%	6
55	7	100%	9
109	3	50%	5

Type of vegetation disturbance may also have affected the score. Where an area had been cleared, but appeared to be recovering (such as from an old logging operation), a lower score was given than to areas that showed furrows or evidence of recent mowing. It should be noted that accounting for type of vegetation disturbance based on aerial imagery is more of an indication of where problems may be occurring than it is a precise assessment of the ecological condition of the wetland. Even if an area has obviously been cleared, the vegetation community may be intact with native wetland species. Late in the analysis it was determined that fields with obvious furrows should receive points for geomorphic disturbance. However, in order to maintain consistency through the analysis, fields were considered vegetation disturbances only. The following table shows the types of conditions that lead to each vegetation disturbance score, showing that vegetation disturbance score begins with geomorphic score and then is increased by % of the polygon where vegetation has been disturbed. The combination of the percent area affected and the relative severity of the disturbance (L=low; M=medium; H=high) determine the score.

Base: Geomorphic Disturbance Score	*factor in…* Percent vegetation disturbance	*consider also…* Relative impact of vegetation disturbance	→ *Result:* Score including geo. and Vegetation disturbance	*Details*: A wetland receives a Score including Geomorphic disturbance and Vegetation disturbance when the following characteristics apply…
0	0	na	0	Maximum Geo. score of 0; Can be given when there is a Maximum of 5% vegetation disturbance
0	10%	L	1	Maximum Geo. score of 1; usually with 10% veg disturbance. Maximum of 20-30% veg disturbance if geo. score is 0 and/or type of disturbance seems minimal or area appears to be recovering
1	0	na		
1	20%	M	2	Maximum geo. score of 2. Can be given when geo score is 1 and there is some veg disturbance. Maximum 30%-50% vegetation disturbance if geo. score is 0 and/or type of disturbance seems minimal or area appears to be recovering.
2	10%	L		

1	50%	L	3	Maximum Geo. score of 3. 3 Can be given when geo score is 2 and there is some veg disturbance. Can be given when up to 100% of the area has been disturbed if impact seems low or area appears to be recovering.
2	30%	M		
1	60%	M	4	Maximum geo. score of 4. Can be given if geo. score is low but there is a high amount of veg disturbance.
1	40%	H		
3	20%	M		Can be given when geo score is 2 or 3 and there is a small amount or low-impact veg disturbance.
0	100%	L	5	5 can be given when up to 100% of the area has been disturbed when there is no geo. disturbance. Also given when up to 5 geo. disturbance score but low extent and impact of vegetation disturbance
3	50%	M		
5	10%	L		
1	100%	L	6	Given if up to 100% veg disturbance but low geo. disturbance Maximum geo. score of 6 if no veg. disturbance.
5	30%	M		
2	100%	L	7	Given if up to 100% veg disturbance but low to medium geo. disturbance. Maximum geo. score of 7 if no veg. disturbance. If geo score is already high, high % veg. disturbance increases total score by a few points.
5	80%	M		
3	100%	L	8	Given if up to 100% veg disturbance and medium geo. disturbance. Maximum geo. score of 8 if no veg. disturbance. If geo score is already high, high % veg. disturbance increase total score by a few points.
6	80%	M		
7	100%	H	9	Given if up to 100%, high impact veg disturbance and high geo. disturbance. Maximum geo. score of 9 if no veg. disturbance. If geo score is high, high % veg. disturbance does not greatly increase total score.
9	70%	H		
9	100%	H	10	Given if up to 100% veg disturbance, high veg impact of veg disturbanc, and high geo. disturbance.
10	100%	H		

7) Percent of polygon occupied by an excavated pond:
Many wetland and non-wetland areas in Island County have been excavated and converted to ponds for watering livestock or aesthetic value. These human-made ponds received a separate rating due to their dual status. They represent a disturbance (excavation) as well as -- where a wetland did not previously exist -- the creation of a wetland. Polygons that received more than 40% in the "pond" category received a "**P**" for pond. Percentage could not be used as a direct way of creating this pond score since most polygons based on ponds had high mapping errors, that is, half of the pond was often inside the polygon and half outside of it. The 40% threshold accounts for most of those errors.

8) Relative certainty about disturbance:
Sometimes disturbances were difficult to determine. For instance, roads and ditches were difficult to detect under forest canopies and on slopes, even using LiDAR. Relative certainty of disturbance was rated for each polygon as either high (H) medium (M) or low (L). This category was included to give a general assessment of how well the LiDAR works for detecting disturbances rather than for use in relation to each specific polygon and was not used for any quantitative analysis.

9) Topography: % Flat:
The general topography within the wetland polygon was noted. Some wetland polygons have definite hills within them making the process of determining slope vs. flat very straightforward. However, others lay on gentle slopes where it was difficult to tell if the wetland actually lay in a flat section in a sloping area or on the sloping area. For those wetlands a score was given that included a small % slope to account for some sloping. The general policy for polygons without obvious hills was to consider a wetland as sloped if the polygon included at least one contour line (indicating a 10-foot drop in elevation). The percent area above or below (whichever was less) that line was used for percent sloped. Contour lines or hill shade that only indicated a difference in elevation between forested and non-forested areas were ignored because it is likely that the elevation difference was a function of the different vegetative cover. Where slight hills could be noted in the LiDAR but not by the contour lines, a change in topography was assumed.

10) Estimate of natural wetland area:
This category notes when a large, disturbed polygon contains an area that appears to be remnant natural wetland. For instance, a large polygon with many fields and disturbances but which also contains a natural wetland composing 20% of the area, is noted as 20% natural wetland. This category was also used to denote instances where the entire polygon appeared to be a natural wetland. No number was entered when it could not be determined whether the area was natural or not, or when the polygon was obviously a pond. This category was added partway through the analysis, so is not complete across all wetlands. Because of this, the results cannot be used to make conclusions about the percent wetlands with remnant natural wetland area throughout the County.

11) Mapping errors:
Mapping errors were often noted in the process of reviewing all wetland polygons. The most common error was a significant polygon offset, such as when a polygon obviously was supposed to represent a pond, but only half of the pond was included and the other half lay outside the polygon. This category also included mention of disturbances that occurred inside or outside of known wetlands as compared to the mapped polygon (information gathered during summer 2005 field visits).

Appendix C6. Change Analysis Procedures Using SPOT Imagery and Aerial Photographs

This part of the wetland analysis was intended to identify and generally quantify changes, both positive and negative, that occurred after Island County's first wetlands ordinance was enacted in 1984, but prior to 1998 (because that was the most recent year for which comparable aerial photographs were available in digital format). Orthorectified versions of aerial photographs from May 1985 were scanned and compared visually with similarly orthorectified aerial photographs taken in May 1998. The original scale of both photos was 1:200. Subsequently, the May 1998 aerial photograph was compared with a digital SPOT satellite image from 2005, to detect more recent negative changes.

In each image, concentric rings were drawn at distances of 0-25, 25-50, 50-75, 75-100, 100-150, 150-200, and 200-300 ft from the composite wetland polygon boundary as depicted by our maps. These distance categories (zones) were mostly chosen arbitrarily. Zones beyond 100 ft are generally not regulated by the County. In each zone, changes visible in each of eight compass sectors (N-NE, NE-E, E-SE, SE-S, S-SW, SW-W, W-NW) were noted and recorded in the database. Given the limitations of the imagery, even under magnification the only types of changes that could be identified with relative confidence were:

Negative Change

- new buildings (b)
- new roads including driveways whether paved or not (r)
- major clearing of woody canopy or ground vegetation (c)

Positive Change

- building overgrowth (bo)
- building removal (br)
- road overgrowth (ro)
- road removal (rr)
- clearing re-growth (c)
- vegetation growth (vg)
- pond removal (pr)
- pond creation (pc)

After all comparisons had been completed, changes were represented by the number of zone-sector combinations (7 zones x 8 compass directions = 56) with changes.

Considerable caution is required when interpreting these data because:
(a) wetland polygon boundaries have not been field-verified so are very approximate,
(b) consequently the positions of the rings that are tied to the wetland boundary have a significant spatial error, probably greater than the separation distances between the rings;
(c) the quality of the scanned images was not exactly the same for the two time periods being compared,
(d) changes occurring under a tree canopy were seldom visible, and
(e) some changes may have occurred after 1998 but had become invisible by 2005 due to vegetation succession and canopy overgrowth. For these and other reasons, without actually visiting a wetland no inference should be made about the legality of changes that may have occurred.

Appendix C7. Procedures for Review of ICPCD Permit Files

Most non-digitized data available for the Wetland Study exist in hard-copies of notes and drawings that the County refers to as the **wetland file**. The **wetland file** was originally created as a result of adoption of regulation in the 1985 wetland protection ordinance. The purpose of the **wetland file** is to serve as a repository for all wetland-related information that was collected or created since the original wetland ordinance. The collection of information was then used as a resource to help identify previously unknown wetlands and as a record of activities that have occurred in or near wetlands. The **wetland files** are organized based on section, township, and range and are physically located within the Planning Department office.

Since 1985, six types of permits have proven to be especially relevant to activities that might affect physical impacts to wetlands. These six permit types produced the bulk of the information in the **wetland file**:

- **Critical Area Alteration (CAA) –** This permit is required whenever a property owner proposes an alteration to any critical area, including wetlands[27]. If a wetland is involved in the proposed action, a wetland delineation and/or biological site assessment usually accompany the CAA. A CAA is also necessary to repair or mitigate for unpermitted alterations to critical areas.
- **Use Approval (USA) –** The USA is virtually the same as the CAA. The USA was replaced by the CAA in 1998.
- **Clearing and Grading Permit (CGP) –** A CGP is required for any significant land disturbance such as earth-moving, large-scale forestry activities, stump removal or surface grading[28]. The CAO requires that no alteration of the land within the buffer of a critical area shall occur, thus County staff routinely investigates areas of proposed disturbance before work begins. This has led to numerous requirements for wetland delineations for work that is proposed near wetlands. Occasionally, wetlands that were not on the County critical areas map (especially wooded wetlands) have been discovered through the site review process (see below for site review process). This is not uncommon because much of the mapping of wetlands was performed using aerial photography, which would not reveal wooded wetlands.
- **Short Subdivision permit (SHP) and Preliminary Long Plat permit (PLP) –** These permits are necessary when a landowner desires to subdivide his or her property. A SHP is used when four or less new parcels are to be created; PLP when more than four new parcels are created. If a wetland is present anywhere on the property, the wetland boundaries and the required buffer are included on the official plat map that is recorded with the County Auditor's Office. The plat map and supporting documentation is included in the **wetland file**.
- **Building permit** (BP) – construction of any structure not exempt in the International Building Code Section R105[29] requires a building permit from the Island County Department of Planning and Community Development. A site plan and structural drawing are required for all proposed structures. These drawings are included in the **wetland file** if the structure is near a regulated wetland or its buffer.

[27] The full rules governing critical area alterations are in 17.02.04.
[28] Specific thresholds that trigger the necessity of a CGP are in ICC 11.02.08.
[29] Adopted under ICC 14.01A.010.

In addition to reviewing ICPCD's wetland files, we undertook a guided (non-systematic) review of land-use permits. In this Land-Use Permit review, all permit files that were known to involve wetlands were thoroughly examined to determine how the project affected the wetland involved. The results of the individual file reviews were compiled in a narrative style to convey the specific circumstances that affected the permit review process. Each entry provides all of the following information (when available):

- A synopsis of the project as proposed by the applicant;
- File number;
- Auditor's parcel(s) on which the action was proposed;
- Wetland ID number (from "wv_comp06_Finally");
- Category of wetland;
- Other file numbers associated with the action and/or Auditor's parcel;
- Concerns the County had about the impact of the proposed action to the wetland or wetland buffer;
- Changes to the proposed action (if any) required by County staff to reduce the impact on the wetland or buffer;

The narrative format is different than the quantitative format followed in the **wetland file** review, where the amount of wetland affected was the focus of the review. Quantitative analysis was an aspect of the Land-Use Permit Review, but the goal of the review was to capture some insight into the type of circumstances that lead to the conditions allowed in the permits.

Beyond the fact that a narrative approach to the Land-Use Permit Review best meets the goals of the project, the process necessary to accomplish the review did not lend itself to a proper qualitative analysis. The system used to track the land-use files is not so sophisticated that it indicates whether a file involves a wetland. Nor is the database linked to a GIS parcel layer, thus it is not possible to spatially review whether the location of the project is near a wetland. Since the file tracking database is not capable of producing a definitive list of files that involve wetlands, the only way to produce a list of files that that is satisfactorily comprehensive enough to be used in a true qualitative analysis is to manually review every land-use file opened since the inception of the County wetland regulations in 1984. This was neither practical nor necessary since only a small percentage of the overall number contains wetland-related information. Therefore a guided review of files known to involve wetlands was the approach deemed the most appropriate.

Two methods were used to identify which land-use files might have information pertaining to wetlands. First, a query was run in the County Development Permits database for all permits that have the word "wetland" in the Proposal field. The Development Permits is a Microsoft Access database that contains several fields including parcel number, Land-Use Permit Type, Permit Number and Proposal. The final field is the only one dedicated to comments related to the proposed action. The query returned 36 results.

Because of the low rate of return produced by this method, an additional manual search was performed. In the manual search, the two Development Coordinators and the Code Enforcement Official, all of whom regularly deal with wetland related issues, were asked to physically review their records to find any files that may involve wetlands. These staffers all keep an electronic copy of all staff reports and communication with applicants on their respective office computers. By looking at the name associated with each file and/or opening the file, staff was able to determine if the file involved a wetland. Through this process a list of files was produced.

The staff lists were then added to the list produced by the earlier the County Development Permits database query, for a total of 88 files that potentially involve wetlands. Of those, about 73 (including streams) did in fact prove relevant to wetlands. As the 73 files were carefully reviewed, additional files associated with the parcel (thus the same wetland) were encountered. For example, a code violation file (COV) often accompanies another permit as code violations may occur when the conditions of the original permit are not followed. If another file was encountered, that file too was reviewed and documented under the same heading as the other associated file(s).

This methodology inevitably led to some overlapping of information between the **wetland file** review and the Land-Use Permit Review. However, the Land-Use Permit Review was not 100% overlapping, thereby indicating limits to the efficiency of the **wetland file** system as a method for tracking activities in and near wetland.

Appendix C8. Archiving of Field Forms and Digital Data Files

All data forms that were filled out for each visited wetland were electronically scanned and PDF-format versions placed on the ICPCD network. They can be located in a folder named according to the ID06 identifier. These are known as the "Site Folders." The Site Folder for all wetlands contains the 2001 LiDAR image, 1998 airphoto, and 2004 SPOT image clipped to that wetland. For some wetlands, much reference information has been scanned and placed in the Site Folder, such as plant lists from others who have studied the wetland, consultant reports, and photographs taken during the 2005 field visit (and winter visit also, if photographed then).

As was described in Appendix C4, this project has created a geodatabase that catalogues the attributes of Island County wetlands, their surrounding areas and contributing areas. Anyone with rudimentary computer skills can view the composite wetland polygon map, locate a wetland of interest, write down the identifier number, and then use that identifier to find attributes of that wetland and its surroundings in any of several electronic files. The electronic files are available upon request from the ICPCD. They are protected from alteration except by their author and are formatted in Excel®. All were converted from Dbase format (which ArcMap uses) to Excel. All files share the wetland identifier (ID06 data field) and thus can be linked and queried as needed. A copy of each file will be kept both on the ICPCD computer network and at Dr. Adamus's ftp site at Oregon State University:

www.oregonstate.edu/~adamusp/Puget

From time to time, if errors are noticed in the data, the files at both sites may be updated. We welcome suggestions for corrections. Spatial data layers (shapefiles and other ESRI files) are archived on the ICPCD network but not at Oregon State.

In concept, the geodatabase has four main components: 1) source coverages, 2) shapefiles generated by the overlay of the source coverages with wetland polygons and other spatial units, 3) databases, and 4) variables. The following metadata table shows the relationships between all the source coverages and Excel databases. The data dictionary (Appendix B) then shows the relationships between the Excel databases in the last column and the 1000+ variables that were generated, thus allowing variables to be traced to their source.

Theme, indicating type (point, line or polygon)	**Original Source:**	**Associated Shape Files:**	**Excel Files in Which Variables (listed in Appendix B) Are Mainly Located:**
NWI Wetlands (poly)	US Fish & Wildlife Service	NWI_NAD83.shp	WDB6
IC Wetlands (poly)	Island County	Wetland_98.shp & new_wet_05.shp	WDB6
Composite Wetlands (poly)	Island County	wv_comp06.shp	(all)
DNR Soil (poly)	WA-Dept. of Natural Resources	DNR_soils03.shp	WDB6
NRCS Soil (poly)	Natural Resource Conservation Service	Nrce_soils03.shp	WDB6
Groundwater Susceptibility (poly)	Island County	groundwater suscept.shp	WDB6
Natural Heritage Program Areas (poly)	WA-Dept. of Natural Resources	nhp_comm.shp	WDB6
Zoning (poly)	Island County	zoning.shp	DDB6
Stormwater Management Areas (poly)	Island County	Crit_drain_00.shp	DDB6
DNR Forest Practice	WA-Dept. of Natural	DNR-FP_IC.shp	DDB6

Theme, indicating type (point, line or polygon)	**Original Source:**	**Associated Shape Files:**	**Excel Files in Which Variables (listed in Appendix B) Are Mainly Located:**
Areas (poly)	Resources		
Streams (line)	WA-Dept. of Natural Resources	Isl_hydro_line.shp	WDB6
Precipitation (poly)	Oregon State University	Wa24h2y – (24 hour event, 2 year return) Wa2h2y- (2 hour event, 2 year return)	WDB6
Land Cover (poly)	University of Washington	Lc92_83.shp Lc98_83.shp	DDB6
Habitats of Local Importance (poly)	Island County	localimportance.shp	WDB6
Priority Habitats (poly)	WA-Dept. of Fish & Wildlife	Phspoly.shp	WDB6
Roads (line)	Island County	County.shp	DDB6
Wetland Contributing Areas (poly)	Island/Skagit County	Contib06_finally.shp	DDB6
Watershed Boundaries (poly)	Island County	Basins.shp	WDB6
Developed Areas (poly)	Island County	Develop.shp	DDB6
Compound Topographic Index (point)	Island/Skagit County	Site_snap.shP Terrestrial_snap.shp	WDB6
Surrounding Zones (poly)	Island County	B0i.shp, B1i.shp, B2i.shp, B3i.shp, F06B.shp	BUFFGEN, BUFFLCOV
Wetland Point ID	Island County	SiteID_wet.shp	(all)
Surface water sample (point)	Island County	surfH20_pts.shp	DDB6
Ground water sample (point)	Island County	Gps_well_pts.shp	DDB6
Data from 2005 visits: WDOE Rating System	Island County	(not applicable)	WDOE_COMBINED
Data from 2005 visits:Botanical	Island County	(not applicable)	BMETRIX, BOTSPMATRIX, WPLANTS
Data from 2005 visits:Other	Island County	(not applicable)	WDB6, DDB6
Airphoto Interpretations of Changes, 1985_1998			CHANGE_1985_1998
Airphoto Interpretations of Changes, 1998- 2005			CHANGE_1998_SPOT05

APPENDIX D. SUPPLEMENTAL DATA AND DATA SUMMARIES

Appendix D1. Results from WDOE Wetland Rating System Applications

Table D1.1. Mean (range) of WDOE Function Scores for Surveyed Island County Wetlands Compared With Scores From Elsewhere In Western Washington

	Depressional Wetlands		Slope Wetlands	
	Island County (n= 55 wetlands)	W. Washington (n= 65 wetlands)	Island County (n= 25 wetlands)	W. Washington (n= 11 wetlands)
Water Quality Function	14.29 (1-32)	18.87 (6-32)	10.55 (3-22)	8.7 (3-16)
Hydrologic Function	10.34 (3-24)	14.18 (2-28)	7.55 (2-16)	10.3 (2-16)
Habitat	20.96 (8-31)	20.89 (4-34)	20.96 (8-31)	20.89 (4-34)

Table D1.2. Number and percent of wetlands in each category of the WDOE Western Washington Rating System, comparing Island County results from 2005 with results from Western Washington wetlands selected and assessed by WDOE staff

Wetland Type	Sample	Category I	Category II	Category III	Category IV	Score* Average	Score* Range
Depressional	IC 2005 (55%, n=55)	4 (7%)	13 (26%)	28 (51%)	10 (16%)	(38.24) 44.25	(15-57) 15-67
	WDOE (53%, n=65)	14 (22%)	26 (40%)	23 (43%)	2 (3%)	54.15	23-86
Slope	IC 2005 (25%, n=25)	0	3 (12%)	20 (80%)	2 (8%)	(35.00) 41.32	(18-47) 24-63
	WDOE (9%, n=11)	0	1 (9%)	5 (45%)	6 (55%)	34.17	14-54
Riverine	IC 2005 (2%, n=2)	1 (50%)	1 (50%)	0	0	(49.50) 67.00	(47-52) 64-70
	WDOE (30%, n=36)	10 (28%)	20 (56%)	8 (22%)	1 (3%)	59.82	19-93
Lacustrine	IC 2005 (2%, n=2)	0	2 (100%)	0	0	(45.50) 59.50	(44-47) 56-63
	WDOE (6%, n=7)	0	3 (43%)	3 (43%)	2 (29%)	40.25	12-60
Coastal Lagoon	IC 2005 (8%, n=8)	2 (25%)	6 (75%)	0	0	n.a.	n.a.
	WDOE (0%, n= 0)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Tidal	IC 2005 (7%, n=7)	3 (43%)	4 (57%)	0	0	n.a.	n.a.
	WDOE (2%, n=3)	0	2 (67%)	1 (33%)	0	n.a.	n.a.
TOTAL	IC 2005 (n=100)	10 (10%)	29 (29%)	48 (48%)	12 (12%)	(37.71) 44.29	(15-57) 15-70
	WDOE (n=122)	24 (20%)	52 (43%)	43 (35%)	11 (9%)	53.13	12-93

* The upper numbers in parentheses in the last 2 columns are the modified scores (i.e., did not account for Opportunity component of the Water Quality and Hydrologic functions)

Table D1.3. Distribution of WDOE Rating System scores for Depressional wetlands, comparing Island County results with results from Western Washington Depressional wetlands assessed by WDOE staff

Shading indicates median values in columns 4 and 6.

WDOE Category (based only on score*)	WDOE score	# of visited IC Depressional wetlands with that score	% of visited IC Depressional wetlands with that score or lower	# of visited W. Washington Depressional wetlands with that score	% of visited W. Washington Depressional wetlands with that score or lower
Category IV	15	1	2%	0	0%
	21	1	4%	0	0%
(10 IC wetlands)	23	0	4%	1	2%
	25	0	4%	1	3%
(lowest functioning)	27	1	5%	0	3%
	28	5	15%	0	3%
	29	2	18%	0	3%
Category III	33	1	20%	1	5%
	34	1	22%	1	6%
(27 IC wetlands)	35	1	24%	1	8%
	36	1	25%	1	9%
	37	1	27%	0	9%
	38	2	31%	0	9%
	39	2	35%	1	11%
	40	1	36%	1	12%
	41	2	40%	1	14%
	42	2	44%	3	18%
	43	1	45%	2	22%
	44	0	45%	1	23%
	45	3	51%	3	28%
	46	1	53%	2	31%
	47	1	55%	1	32%
	48	5	64%	2	35%
	49	1	65%	4	42%
	50	1	67%	2	45%
Category II	51	1	69%	0	45%
	52	4	76%	2	48%
(19 IC wetlands)	53	1	78%	3	52%
	54	1	80%	0	52%
	55	2	84%	2	55%
	56	1	85%	0	55%
	57	1	87%	2	58%
	58	0	87%	2	62%
	59	1	89%	3	66%
	60	1	91%	1	68%
	61	1	93%	0	68%
	62	0	93%	2	71%
	63	1	95%	3	75%
	64	1	96%	2	78%
	65	1	98%	2	82%
	66	0	98%	1	83%
	67	1	100%	1	85%
	68	0		2	88%

WDOE Category (based only on score*)	WDOE score	# of visited IC Depressional wetlands with that score	% of visited IC Depressional wetlands with that score or lower	# of visited W. Washington Depressional wetlands with that score	% of visited W. Washington Depressional wetlands with that score or lower
	69	0		1	89%
Category I	71	0		1	91%
	72	0		1	92%
(0 IC wetlands)	73	0		1	94%
	74	0		1	95%
(highest functioning)	77	0		1	97%
	81	0		1	98%
	86	0		1	100%

* The WDOE Rating System does not rely only on the scores in column 2 when assigning a wetland to a category. "Special Characteristics" are also taken into account.

Table D1.4. Distribution of WDOE Rating System scores for Slope wetlands, comparing Island County results with results from Western Washington Slope wetlands assessed by WDOE staff

Note: None of the visited Slope wetlands in Island County was in the highest category (category I), even after considering their "Special Characteristics." Shading indicates median values in columns 4 and 6.

	WDOE score*	# of visited IC Slope wetlands with that score	% of visited IC Slope wetlands with that score or lower	# of visited W. Washington Slope wetlands with that score	% of visited W. Washington Slope wetlands with that score or lower
Category IV	15	0	0%	1	9%
	17	0	0%	1	18%
(2 IC wetlands)	22	0	0%	1	27%
	24	1	4%	2	45%
(lowest functioning)	25	1	8%	0	45%
Category III	30	1	12%	0	45%
	31	1	16%	0	45%
(19 IC wetlands)	33	0	16%	0	45%
	35	1	20%	1	55%
	36	2	28%	0	55%
	37	1	32%	0	55%
	38	3	44%	0	55%
	39	2	52%	0	55%
	40	2	60%	1	64%
	43	1	64%	0	64%
	44	0	64%	2	82%
	45	2	72%	1	91%
	46	0	72%	0	91%
	47	2	80%	1	100%
	48	1	84%		
Category II	53	1	88%		
	57	1	92%		
(4 IC wetlands)	59	1	96%		
	63	1	100%		
Category I (0 IC wetlands)					

Table D1.5. Distribution of *modified* WDOE Rating System scores for visited Depressional wetlands in Island County

The WDOE Rating System does not translate unweighted scores such as these into categories, but for possible regulatory purposes, Island County might consider (for Depressional wetlands) a categorization such as the following based on the data we collected in summer 2005:

Category I= unweighted score of >45 (>75th percentile)
Category II= unweighted score of 38-44 (50th – 75th percentile)
Category I= unweighted score of 31-37 (25th – 50th percentile)
Category II= unweighted score of <31 (<25th percentile)

As specified in the WDOE Rating System, a wetland would be moved into a higher category than dictated by the score alone if a Special Characteristic is present. Shading indicates the median.

WDOE score (unweighted, excludes Water Quality & Hydrologic Opportunity)	# of visited IC Depressional wetlands with that score	% of visited IC Depressional wetlands with that score or lower
15	1	2%
18	0	2%
19	1	4%
22	0	4%
23	1	5%
24	3	11%
26	3	16%
27	1	18%
28	2	22%
29	1	24%
31	1	25%
32	1	27%
33	3	33%
34	1	35%
35	1	36%
36	2	40%
37	2	44%
38	3	49%
39	2	53%
40	2	56%
41	2	60%
42	2	64%
43	3	69%
45	2	73%
46	2	76%
47	2	80%
48	3	85%
49	1	87%
51	1	89%
52	3	95%
53	1	96%
54	1	98%
57	1	100%

Table D1.6. Distribution of *modified* WDOE Rating System scores for visited Slope wetlands in Island County

The WDOE Rating System does not translate unweighted scores (scores that exclude the Opportunity component) such as these to categories, but for possible regulatory purposes, Island County might consider (for Slope wetlands) a categorization such as the following based on the data we collected in summer 2005:

Category I= unweighted score of >38 (>75th percentile)
Category II= unweighted score of 35-38 (50th – 75th percentile)
Category I= unweighted score of 31-37 (25th – 50th percentile)
Category II= unweighted score of <31 (<25th percentile)

As specified in the WDOE Rating System, a wetland would be moved into a higher category than dictated by the score alone if a Special Characteristic is present. Shading indicates the median.

WDOE score (unweighted, excludes Water Quality & Hydrologic Opportunity)	# of visited IC Slope wetlands with that score	% of visited IC Slope wetlands with that score or lower
15	0	0%
18	1	4%
19	0	4%
22	1	8%
23	0	8%
24	0	8%
26	0	8%
27	0	8%
28	2	16%
29	1	20%
31	1	24%
32	3	36%
33	1	40%
34	1	44%
35	0	44%
36	2	52%
37	1	56%
38	5	76%
39	1	80%
40	0	80%
41	2	88%
42	0	88%
43	1	92%
45	0	92%
46	1	96%
47	1	100%

Table D1.7. Frequencies of WDOE Rating System Variables in Island County Wetlands and Their Surroundings

WDOE Item	# of the visited non-estuarine IC wetlands having that condition:	%	# of wetlands visited in W. Wash by WDOE with that condition (includes depress, slope, lacus ONLY)	%	# of wetlands visited in W. Wash by. WDOE with that condition	%	Description
-	100		83		122		total # of wetlands assessed with the WDOE Rating Form
C1					3	2%	Tidal Fringe
C1.1							Freshwater Tidal Fringe
C1.2							Salt Water Tidal Fringe (Estuarine)
C3	2	2%	7	8%	7	6%	Lacustrine Fringe
C4	24	29%	10	12%	10	8%	Slope
C4.1	20	24%					Slope - on a slope
C4.2	20	24%					Slope - unidirectional flow
C4.3	18	21%					Slope - outflow unimpounded
C5	5	6%			36	30%	Riverine
C6	60	71%	66	80%	66	54%	Depressional
C8	1	1%	0	0%	0	0%	Multiclass
C8.1	1	1%					Slope & Riverine
C8.2	8	10%					Slope & Depressional
C8.6	3	4%					Salt Water Tidal Fringe & any other class of freshwater wetland
D1.1.1	33	39%	22		22		Depression no outlet
D1.1.2	23	27%	22		22		Constricted or intermittent outlet
D1.1.3	1	1%	22		21		Unconstricted outlet
D1.1.4	1	1%					No outlet, Flat, or outlet is ditch
D1.2	57	68%	39	59%	38	58%	Clay, organic, or hydrogen sulfide in upper 2" of soil - Depressional
D1.3.1	26	31%	41	62%	41	62%	Dense persistent ungrazed veg is >95% of area
D1.3.2	12	14%	23	35%	22	33%	is >50%
D1.3.3	15	18%	2	3%	2	3%	is >10%
D1.3.4	5	6%	0	0%	0	0%	is <10%
D1.4.1	6	7%	41	62%	41	62%	Seasonal is >50% of area
D1.4.2	21	25%	10	15%	9	14%	>25%
D1.4.3	27	32%	13	20%	13	20%	<25%
D2.1	16	19%					Grazed within 150 ft - Depressional

WDOE Item	# of the visited non-estuarine IC wetlands having that condition:	%	# of wetlands visited in W. Wash by WDOE with that condition (includes depress, slope, lacus ONLY)	%	# of wetlands visited in W. Wash by. WDOE with that condition	%	Description
D2.2	13	15%					Stormwater flows into wetland
D2.3	8	10%					Tilled fields or orchards within 150 ft - Depressional
D2.4	18	21%					Channel from developed or farmed or roads or clearcut - Depressional
D2.5	25	30%					Residential, urban, or golf courses within 150 ft - Depressional
D2.6	1	1%					Enriched groundwater
D2.7	5	6%					other2.7
D3.1.1	28	33%	22	33%	22	33%	No outlet
D3.1.2	26	31%	22	33%	22	33%	Constricted or intermittent outlet
D3.1.3	1	1%	0	0%	0	0%	No outlet or outlet is ditch
D3.1.4	3	4%	22	33%	21	32%	Unconstricted outlet
D3.2.1	7	8%	14	21%	14	21%	>3 ft storage
D3.2.3	14	17%	16	24%	16	24%	2-3 ft storage
D3.2.4	27	32%	29	44%	29	44%	0.5-2ft storage
D3.2.5	4	5%	0	0%	0	0%	flat with small depressions
D3.2.6	6	7%	6	9%	5	8%	<0.5 ft storage
D3.3.1	22	26%	22	33%	22	33%	Basin is <10x wetland area
D3.3.2	33	39%	37	56%	36	55%	Basin is 10-100x wetland area
D3.3.3	3	4%	8	12%	8	12%	Basin is >100x wetland area
D4.1	1	1%	2	3%	2	3%	Headwater of channel with Flooding Problems
D4.3	1	1%	20	30%	20	30%	No outlet and impounds surface water
D4.4	3	4%	0	0%	0	0%	other4.4
H1.1	2	2%					number of qualifying Cowardin vegetation types is 1 (0 points)
	6	7%					number of qualifying Cowardin vegetation types is 2 (1 point)
	16	19%					number of qualifying Cowardin vegetation types is 3 (2 points)
	59	70%					number of qualifying Cowardin vegetation types is 4 or more (4 points)
H1.1.1	29	35%	25	30%	33	27%	Aquatic bed >10% of area or >1/4 acre
H1.1.2	85	101%	68	82%	94	77%	Emergents
H1.1.3	79	94%	55	66%	80	66%	Scrub-shrub with >30% cover
H1.1.4	71	85%	46	55%	67	55%	Forested with >30% cover

WDOE Item	# of the visited non-estuarine IC wetlands having that condition:	%	# of wetlands visited in W. Wash by WDOE with that condition (includes depress, slope, lacus ONLY)	%	# of wetlands visited in W. Wash by. WDOE with that condition	%	Description
H1.1.5	54	64%	2	2%	2	2%	Forested has 3 of 5 strata
H1.2	4	5%					number of qualifying hydroperiod types is 1 (0 point)
	31	37%					number of qualifying hydroperiod types is 2 (1 point)
	32	38%					number of qualifying hydroperiod types is 3 (2 points)
	16	19%					number of qualifying hydroperiod types is 4 or more (3 points)
H1.2.1	40	48%	46	55%	69	57%	Permanently inundated
H1.2.2	53	63%	61	73%	83	68%	Seasonally
H1.2.3	38	45%	47	57%	78	64%	Occasionally
H1.2.4	70	83%	41	49%	53	43%	Saturated
H1.2.5	9	11%	0	0%	4	3%	permanent stream in or adjoining wetland
H1.2.6	12	14%	0	0%	0	0%	seasonal stream in or adjoining wetland
H1.2.7	2	2%	7	8%	7	6%	Lake-fringe wetland
H1.2.8	1	1%			1	1%	Freshwater Tidal wetland
H1.3.1	16	16%	39	47%	60	49%	number of plant species excluding 4 invasives is <5 species (0 points)
	12	12%	30	36%	41	34%	number of plant species excluding 4 invasives is 5 - 19 species (1 point)
	72	72%	14	17%	17	14%	number of plant species excluding 4 invasives is >19 species (2 points)
H1.4.1	15	15%	21		24	20%	Interspersion is none (0 points)
H1.4.2	9	9%	5		15	12%	Interspersion is Low (1 point)
H1.4.3	12	12%	13		20	16%	Interspersion is Moderate (2 points)
H1.4.4	62	63%	44		59	48%	Interspersion is High (3 points)
H1.5.0.2	11	13%					Points for Special Habitat Features = 1 (1 type)
H1.5.0.3	13	15%					Points for Special Habitat Features = 2 (2 types)
H1.5.0.4	15	18%					Points for Special Habitat Features = 3 (3 types)
H1.5.0.5	18	21%					Points for Special Habitat Features = 4 (4 types)
H1.5.0.6	14	17%					Points for Special Habitat Features = 5 (5 types)
H1.5.0.7	2	2%					Points for Special Habitat Features = 6 (6 types)
H1.5.0.1	4	5%					Points for Special Habitat Features = 0 (0 types)
H1.5.1	59	70%	55	66%	84	69%	LWD
H1.5.2	62	74%	54	65%	77	63%	Snags

WDOE Item	# of the visited non-estuarine IC wetlands having that condition:	%	# of wetlands visited in W. Wash by WDOE with that condition (includes depress, slope, lacus ONLY)	%	# of wetlands visited in W. Wash by. WDOE with that condition	%	Description
H1.5.3	8	10%	6	7%	21	17%	Undercut banks
H1.5.4	26	31%	17	20%	37	30%	Steep banks
H1.5.5	36	43%	51	61%	73	60%	Amphibian stems -- 1/4 acre
H1.5.6	53	63%	49	59%	70	57%	the 4 invasives are <25% of area in each stratum
H2.1.1	8	10%					100m of undisturbed occupies >95% of edge
H2.1.2	20	24%					100m of undisturbed occupies >50% of edge
H2.1.3	8	10%					50m of undisturbed occupies >95% of edge
H2.1.4	20	24%					100m of undisturbed occupies >25% of edge
H2.1.5	6	7%					50m of undisturbed occupies >50% of edge
H2.1.6	10	12%					No paved or buildings within 25m of 95% of edge
H2.1.7	9	11%					No paved or buildings within 50m of 50% of edge
H2.1.8	6	7%					buffer heavily grazed
H2.1.9	2	2%					2m of undisturbed occupies >95% of edge
H2.1.10	4	5%					none of above 2.1.10
H2.2.1	9	11%	51	61%	81	66%	corridor >150' wide AND >30% undisturbed AND connects to >250 acres other undisturbed
H2.2.2	38	45%	13	16%	16	13%	corridor >50' wide AND >30% undisturbed AND connects to >25 acres other undisturbed
H2.2.3	39	46%	14	17%	16	13%	within 5 mi of estuary OR 3 mi of field (>40 ac) OR 1 mi of a lake
H2.3	62	74%	23	28%	29	24%	Total number of priority habitats is 0 (0 points)
	29	35%	39	47%	54	44%	Total number of priority habitats is 1 (1 point)
	9	11%	21	25%	34	28%	Total number of priority habitats is 2 (3 points)
H2.3.1	17	20%					Riparian
H2.3.3	6	7%					Cliffs
H2.3.5	9	11%					Mature forest
H2.3.10	2	2%					Urban natural space
H2.3.11	1	1%					Estuary
H2.3.12	14	17%					Marine shoreline
H2.4.1	17	20%	29	35%	45	37%	3+ other wetlands within 1/2 mile and minor connector disturbance

WDOE Item	# of the visited non-estuarine IC wetlands having that condition:	%	# of wetlands visited in W. Wash by WDOE with that condition (includes depress, slope, lacus ONLY)	%	# of wetlands visited in W. Wash by. WDOE with that condition	%	Description
H2.4.2	1	1%			4	3%	lake-fringe wetland with minor lake disturbance and 3+ others within 1/2 mile
H2.4.3	58	69%	33	40%	50	41%	3+ other wetlands within 1/2 mile and major connector disturbance
H2.4.4	1	1%			0	0%	lake-fringe wetland with major lake disturbance and 3+ others within 1/2 mile
H2.4.5	9	11%	12	14%	14	11%	1+ wetland within 1/2 mile
L1.1.1	2	2%			4	57%	veg >10m wide
L1.2.1	1	1%			0	0%	herbs cover >90% of vegetated area
L1.2.2	1	1%			0	0%	herbs cover >2/3 of vegetated area
L2.7	1	1%					parks with lawns within 150 ft of shore
L2.8	1	1%					powerboats on the lake
L3.1	1	1%			4	57%	>75% of veg is woody >10m wide
L3.3	1	1%			0	0%	>25% of veg is woody >10m wide
L4.1	1	1%					structures vulnerable to erosion
L4.2	1	1%					natural resources vulnerable to erosion
R1.1.2	2	2%			6	17%	Depressions >50%
R1.2.1	2	2%			13	36%	Forest or shrub >2/3 of area
R2.1	1	1%					Grazed within 150 ft - Riverine
R2.2	1	1%					Stormwater - Riverine
R2.4	2	2%					Channel from developed or farmed or roads or clearcut - Riverine
R2.5	1	1%					Residential, urban, or golf courses within 150 ft - Riverine
R3.1.2	1	1%			6	17%	wetland width relative to channel width is 10-20
R3.1.3	1	1%			8	22%	wetland width relative to channel width is 5-10
R3.2.1	2	2%			28	78%	>1/3 woody or >2/3 emergents
R4.1	1	1%					flood-vulnerable human structures or activities downstream
R4.2	1	1%					flood-vulnerable natural resource downstream
S1.1.1	2	2%	2	20%	2	20%	Slope <1%
S1.1.2	5	6%	3	30%	3	30%	Slope 1-2%
S1.1.3	11	13%	4	40%	4	40%	Slope 2-5%
S1.1.4	4	5%	1	10%	1	10%	Slope >5%

WDOE Item	# of the visited non-estuarine IC wetlands having that condition:	%	# of wetlands visited in W. Wash by WDOE with that condition (includes depress, slope, lacus ONLY)	%	# of wetlands visited in W. Wash by. WDOE with that condition	%	Description
S1.2	21	25%	0	0%	0	0%	Clay, organic, or hydrogen sulfide in upper 2" of soil - Slope
S1.3.1	12	14%	5	50%	5	50%	Dense persistent ungrazed herb is >90% of area
S1.3.2	3	4%	2	20%	2	20%	Dense persistent ungrazed herb is >50% of area
S1.3.3	5	6%	1	10%	1	10%	Dense woody is >50% of area
S1.3.4	2	2%	2	20%	2	20%	Dense persistent ungrazed herb is >25% of area
S2.1	4	5%					Grazed within 150 ft - Slope
S2.2	5	6%					Stormwater - Slope
S2.3	4	5%					Tilled fields or orchards within 150 ft - Slope
S2.4	7	8%					Residential, urban, or golf courses within 150 ft - Slope
S2.5	2	2%					other 2.5
S3.1.1	8	10%	7	70%	7	70%	Dense unmatted rigid veg covers >90%
S3.1.2	10	12%	1	10%	1	10%	Dense unmatted rigid veg covers >50%
S3.1.3	2	2%	2	20%	2	20%	Dense unmatted rigid veg covers >25%
S3.1.4	2	2%	0	0%	0	0%	>25% is not rigid or is grazed, mowed, or tilled
S3.2	22	26%	7	70%	7	70%	microdepressions occupy >10% of area
S4.1	1	1%					drains to channel with flooding problems
S4.2	6	7%					other 4.2
SC3.1	2	2%					Peat or muck comprise >16 inches of soil profile
SC3.2	1	1%					Peat or muck with hardpan (clay or ash), or floating in lake
SC3.3	3	4%					>70% moss cover and bog plants comprise >30% cover
SC3.4	1	1%					>30% cover of wetland forest plus bog plants comprise >30% ground cover

Appendix D2. WDOE Rating Method: Repeatability Testing Summary

Repeatability refers to the tendency of multiple users of a standardized method to arrive independently at the same rating or score. We tested the repeatability of the WDOE *Wetland Rating System for Western Washington* (Hruby 2004) as applied to (a) 12 Island County wetlands assessed independently by crew members (called "*within-crew*" testing), and (b) one Island County wetland that had been rated by the Rating System's author and colleagues at a prior time (called "*among-crew*" testing).

The participants in this repeatability test were mainly the two field crew members, one of whom had taken the WDOE training course in the System. In a few instances Paul Adamus, who also had attended the training, participated in the testing. The repeatability testing was conducted after the testers had applied it to Island County wetlands for much of the field season, and thus were generally familiar with each others' thought processes. At each wetland subjected to testing, the raters completed the assessment forms individually and did not compare answers until returning to the office.

Within-crew Testing

The 12 wetlands used for within-crew testing were chosen opportunistically. By the HGM classification, 11 were classified as "Depressional" and one was classified as "Slope". Table D2.1 shows the Total Scores given by each rater at each wetland.

The testing participants independently arrived at the same WDOE category for the wetland in 75% of the tests. It is difficult to interpret the significance of this repeatability rate without comparison to repeatability rates associated with the alternatives: the currently-used Island County categorization criteria, or wetland ratings assigned without use of a standardized assessment tool, i.e., "best professional judgment." However, no repeatability testing was done of those two alternatives.

The category assigned to a wetland is determined mainly by the wetland's Total Score, the sum of 3 major functional groups (Water Quality, Hydrology, Habitat). The Total Score differed little between raters (median difference of 3.3 points on a scale with a theoretical range of 94 points). A difference in scores greater than 3 points only occurred five times, and the maximum difference between scores was 7 points (occurred when 3 people were rating the same wetland; the difference between the other two only differed by 1 point). Despite the generally small point differences, some of these differences occurred near a threshold score between Categories, resulting in the 25% of cases where wetlands were placed in different Categories.

Table D2.1. Comparison of results from two independent users of the WDOE Rating System

Rater1* Total Score	Rater2* Total Score	Difference in Score	Difference in Category
33	33	0	no
45	46	1	no
57	55	2	no
54	52	2	no
43	40	3	no
40	43	3	no
62	65	3	no
51	47	4	yes
31	26	5	yes

Rater1* Total Score	Rater2* Total Score	Difference in Score	Difference in Category
20	26	6	no
55	48	7	yes

* Rater1 and Rater 2 were not the same persons for every wetland but rather are combinations of three different people rating the wetlands. See the table at the end of this appendix for more score details.

In the one test where three people rated the same wetland, two raters came up with very similar scores (difference of 1 point) but the third rater gave a greatly different score because of scoring differently just a single but a very pivotal variable, one dealing with "opportunity" (a component of wetland value).

As is true of most rapid assessment methods, scores for individual variables differed more often among users than did the resulting Total Score and ultimately, the assigned category.

		Number of times answers differed
Water Quality Functions		
D1.1	Water outlet	1
D1.2	organic or clay soils	4
D1.3	Vegetation	3
D1.4	Ponding	2
D2	opportunity?	3
Hydrological Functions		
D3.1	Water outlet	1
D3.2	Storage	7
D3.3	Basin/wetland ratio	5
D4	opportunity?	1
Habitat		
H1.1	# of Vegetation classes	1
H1.2	Hydroperiods	7
H1.3	Number of Species	0
H1.4	Interspersion	5
H1.5	Special Habitat	10
H2.1	Buffer condition	5
H2.2	Corridor level	4
H2.3	Priority Habitats	3
H2.4	Proximity of other wetlands	3

For each wetland where a repeatability assessment was conducted, raters gave different scores for at least 4 but not more than 7 of 18 items on the WDOE Rating System form. For example, the raters may have rated all four Water Quality items differently, but agreed on the points given in the other categories.

In 82% of the cases where scores differed between raters, the differences in scores were only a difference in one "level" of rating. For example, where a wetland could be marked as having from 1 to 4 vegetation classes, one rater selected 2 and the other rater selected 3, the next level up. A maximum number of two items per wetland were given ratings that differed by more than one level.

The most differences in rating occurred in the category "Special Habitat Features". Scores differed in this category in 10 of the 12 wetlands rated. The "hydroperiods" category in the Habitat section and "Depth of Storage" in the Depressional Hydrological function category followed, with different ratings in 7 wetlands.

The reason for the consistent difference in score in the "Special Habitat Features" section is that this category is especially sensitive to user variability because each special habitat feature receives one point, so if even one feature is missed, the scores will vary. Features include such things as downed woody debris and standing snags that may be overlooked if both raters don't cover the same parts of the wetland.

The differences in Hydroperiod scores are due to the fact that hydroperiods are difficult to determine from a single visit to a wetland. A visit during the summer may underestimate the amount of seasonal flooding, and a visit during the winter may overestimate the amount of permanent flooding (see Appendix C3 for documentation of this). The difference between "occasionally flooded" areas and "seasonally flooded" areas is even more subtle and difficult to determine. Even with only 12 repeatability assessments, it could be argued that the hydroperiod estimates are one of the least repeatable parts of the Wetland Rating System, yet in terms of wetland functions, are one of the most important.

The reasons for the variation in the Depressional "Depth of Storage" category are more complex. In many cases no outlet was found, so the "height of ponding above the bottom of the outlet" could not be measured. In those cases, the depth of seasonal ponding above the summer water level was estimated. An additional difficulty in assigning a value to this category is estimating where the high water marks occurred. Water marks and trapped debris are seldom clearly evident in the summer, especially in non-riverine wetlands dominated by annual herbs (i.e., grasses that grow during the spring won't show water marks from the winter). The scoring system is set so that a large difference in score occurs if the apparent marks of ponding are near the threshold between categories. For example, if the ponding appeared to be around 2 feet and one rater estimated a little over 2 feet and the other estimated a little under 2 feet the scores would differ by 2 points. In the repeatability assessment, the differences in scores differed by only one level (i.e., one rater marked "6 inches to 2 feet storage" whereas the other marked "less than 6 inches storage") all but two times.

Other categories where rater's scores differed for 5 or 6 of the wetlands (over 50% of the wetlands assessed) include:

* Hydrology: Basin/Wetland ratio
* Habitat: Interspersion
* Habitat: Buffer Condition

The Basin/Wetland ratio, along with the scores for Corridor Level and Proximity to Other Wetlands, could be determined more consistently using GIS or other imagery. The variation in Buffer Condition is probably influenced the most by the amount of a buffer that could be viewed (this was restricted by limited property access, limited time, and difficulty of movement in forested buffers). Variation in scores for the "Interspersion" variable were attributed simply to human error.

As noted above, a difference between user scores for just one item -- the water quality "opportunity" item -- can be unusually pivotal in terms of the total score and assigned category, because it is used as a score multiplier. In one case, a rater considered a nearby housing area "residential" and the other did not, and in another case one rater noticed a storm water input and another did not. For a third, a rater

included a nearby clear cut in the "other" category whereas the other rater did not. There also were instances, even when the score for a category was the same for both raters, the raters chose that score for different reasons.

Among-crew Testing

Only one Island County wetland had been included by WDOE in their calibration of the Rating System a few years ago, but this one wetland provided a unique opportunity to compare how our results compared with those of the WDOE calibration team. We did not view the WDOE data until after we had conducted our independent assessment of that wetland. The two crews independently assigned the test wetland to Category I. In this instance, differences in the scores for individual data items did not matter because both teams identified the wetland as a bog, which under the Rating System is a "Special Characteristic" that overrides all scores. The crews came up with similar overall scores (52 and 55 points). Regardless, consideration of among-crew differences for individual data items is informative.

Item	Item Description	Points Assigned by IC Raters	Points Assigned by WDOE Raters
D1.1	Water outlet	3	3
D1.2	organic or clay soils	4	4
D1.3	Vegetation	5	5
D1.4	Ponding	0	0
D2	opportunity?	12	12
Total Water Quality Functions (weighted)		24	24
Total Water Quality Functions (unweighted)		12	12
D3.1	Water outlet	4	4
D3.2	Storage	3	5
D3.3	Basin/wetland ratio	5	3
D4	opportunity?	no	no
Total Hydrological Functions		12	12
H1.1	Veg structure	4	0
H1.2	Hydroperiods	2	1
H1.3	Number of Species	2	1
H1.4	Interspersion	3	0
H1.5	Special Habitat	3	3
H2.1	Buffer Category	1	3
H2.2	Corridor level	1	4
H2.3	Priority Habitats	0	1
H2.4	Proximity of other wetlands	3	3
Total Habitat		19	16
Total Score -weighted		55	52
Total Score- unweighted		43	40
number of categories where answers differed:		9	
number of times point scores differed more than up or down one level		5	

Comparing these among-crew results with the within-group results described earlier, it is evident that there were more among-crew differences than within-crew differences. Between Island County raters there was a maximum of 7 categories for a given wetland where answers differed. Between Island County and WDOE raters there were 9 categories where answers differed. Also, the among-crew differences between scores were greater. The maximum number of times point scores differed more than up or down one level between Island County raters was twice; whereas between Island County raters and WDOE raters this happened 5 times.

The two crews agreed on all items in the Water Quality Functions category, and the differences in the Hydrological Functions category differed by only one level each. In the water storage category, WDOE selected >2 feet of storage, where IC selected 6 inches to 2 feet of storage. The other difference here was in the field of basin/wetland ratio. This question is best answered using GIS, and the Island County raters used a GIS-generated contributing areas model (created for this project) to answer this question. Most variability occurred in the "Habitat Functions" category. The same scores were given for only 2 items. Differences are described as follows.

Vegetation Structure. In the Vegetation Structure category, the WDOE raters selected only the "shrub" class whereas as the IC raters selected emergent and forest classes as well. Emergent plants clearly exceeded the minimum area thresholds specified in the Rating System. With regard to the "forested" class, in this wetland trees are somewhat scattered throughout the wetland, and possibly the WDOE raters did not count the dispersed trees as "areas where trees have >30% cover." Also, the WDOE raters might not have considered the forested fringe around the wetland as part of the wetland.

Hydroperiod: In the Hydrology category the IC raters selected one more hydroperiod ("seasonal flooding") than did the WDOE raters. As noted earlier, the within-crew testing showed this category to be one that had much variability between users. During the dry season, detecting a difference between "seasonal flooding" and "occasional flooding" is difficult.

Plant Species Diversity: The WDOE raters recorded only 5 to 19 plant species. The IC team found more than 20. This difference is probably due to the presumably greater time spent searching by the IC team.

Interspersion: IC's interspersion score was higher than WDOE's due to above-noted differences in the classification of vegetation classes.

Buffer Category: There is a paved road around >75% of the wetland's perimeter, and development within 330 feet of the remaining buffer area. It appears the WDOE crew did not notice this, or the road was paved after they completed their assessment.

Corridor Level: The wetland is close to a large (>200 acre) forested area. However, there is a paved road and some development between the bog and the forest. The WDOE may have not considered those as disturbances.

Appendix D3. Field Assessment of Seasonal Water Level Change

One objective of the field-based wetland assessment was to determine the hydrologic regime in each wetland. One part of the regime is a wetland's *hydroperiod*, or the amount of time that a wetland remains flooded (water above the ground surface) or saturated (water to just below the ground surface). The hydroperiods of a wetland can be broken down into rough categories of flooded permanently, seasonally (several months/year), occasionally (2-4 weeks/year), or saturated-only. Both the ICPCD Wetland Data Form and the new WDOE *Western Washington Wetland Rating System* required this information. However, the field-based assessments were completed between July and October 2005, when only permanently flooded areas could be observed, so seasonal flooding was estimated based on vegetation type and high-water marks such as water stains and stranded debris. The accuracy of this information was lower than if conditions could be observed year-round.

To verify the accuracy of these estimates, 18 wetlands were re-visited during January 2006. The wetlands chosen were ones that could be examined from the road and are depressional wetlands, thus more likely to show seasonal variation. Only wetlands on Whidbey Island were revisited, mainly because few wetlands on Camano met the requirements for being both depressional and viewable from the road. To indicate the January water levels, blue lines were drawn on each wetland's sketch map that had been prepared during the dry-season visit. This served as a basis for recalculating the percent of each wetland that is permanently flooded, seasonally flooded, occasionally flooded, or saturated only.

The "seasonally flooded" hydroperiod category was easiest to detect using drive-by observations. Seasonally flooded areas remain ponded for several months in the winter/spring but are not flooded in the summer. Because the duration of flooding is several months, estimates of seasonal flooding made at any time in the winter months should give a reasonable representation of seasonal flooding. Most precipitation in Island County occurs during November and December, so water levels seen in January reflect input from two months of heavy rainfall (*WSU/Island County Precipitation Network*). The area that is "seasonally flooded" was determined by comparing the estimate of seasonally flooded areas predicted during the field visit (determined by looking at erosion, debris and plants) to the observed area of high water. Because the winter check was done only from the road, flooding could not be seen comprehensively and precision is thus still low. Only obvious, major differences were noted.

Summer estimates of winter conditions were frequently found to be wrong. Five of the 18 wetlands observed had winter (seasonal) water levels more than 20% higher than estimated during the summer, and for one of those, the summer projection of winter flooding of 5% of the wetland area was quite different from the reality of 85% of the wetland area. Overall, winter observations increased the estimate of seasonal flooding substantially in 6 of the wetlands, increased slightly in 4, decreased substantially in 2, decreased slightly in 2, and remained the same in 4.

Changes to the category of "occasional" flooding are still just estimates. "Occasionally flooded" areas could not be accurately estimated even during the winter visit because water levels may or may not have diminished 2 weeks after the field visit. Monthly field visits would be needed through early spring to determine which areas of each wetland are only "occasionally" flooded.

The area of "permanently" flooded areas stayed generally the same because estimates of areas that are permanently ponded are most accurate in the summer. The one case in which the estimate of percent permanent water changed was when the January field visit revealed ponded water in an area that was

not included in the original sketch of the wetland area, causing total wetland area to be greater and thus percent of the wetland which is permanently ponded becomes a smaller percent of the whole.

Estimates of the percent of each wetland that remains "saturated only" were increased or decreased depending on the change in the estimate of seasonal flooding. In the case mentioned above where the estimate of seasonal flooding increased dramatically, the estimate of area that never flooded decreased.

The water levels observed during the January 2006 field visit are believed to reflect January levels in Island County over the last few years. The past 5 years of precipitation data for the County show that cumulative rainfall levels during calendar year 2005 were within the annual precipitation range during the previous 5 years. Countywide averages between 2001 and 2004 ranged between 20 and 25 inches, and the average in 2005 was 25 inches. Although precipitation levels vary greatly across the County, recent data from across the County show that rainfall at points across the County in recent years is less than the long-term average. (*site WSU/Island County Precipitation Network*)

Study wetland: July 2005

Same wetland: January 2006

Table D3.1. Results of seasonal flooding assessment.

Numbers in the "difference" column represent the numeric value that the estimate of percent seasonally flooded increased or decreased between time periods-- not the percent increase/decrease.

ID#	Hydroperiod	%: Summer assessment	%: January assessment	Difference in est. of seasonal flooding	ID #	Hydroperiod	%: Summer assessment	%: January assessment	Difference in est. of seasonal flooding
48	2-4 weeks	5	5		240	2-4 weeks	5	5	
	Seasonal	5	5	**0**		Seasonal	50	40	**- 10**
	Permanent	3	3			Permanent	20	20	
	Saturated only	87	87			Saturated only	25	35	
38	2-4 weeks	20	5		154	2-4 weeks	0	0	
	Seasonal	5	5	**0**		Seasonal	80	85	**5**
	Permanent	0	0			Permanent	0	0	
	Saturated only	70	90			Saturated only	20	15	
88	2-4 weeks	5	2		624	2-4 weeks	1	1	
	Seasonal	35	40	**5**		Seasonal	55	70	**15**
	Permanent	10	15			Permanent	5	5	
	Saturated only	50	43			Saturated only	39	24	
144	2-4 weeks	5	5		356	2-4 weeks	0	0	
	Seasonal	30	0	**- 30**		Seasonal	5	90	**85**

ID#	Hydroperiod	%: Summer assessment	%: January assessment	Difference in est. of seasonal flooding
	Permanent	0	0	
	Saturated only	65	95	
96	2-4 weeks	10	10	
	Seasonal	15	35	**20**
	Permanent	35	30	
	Saturated only	50	25	
374	2-4 weeks	5	5	
	Seasonal	2	45	**43**
	Permanent	1	1	
	Saturated only	95	44	
171	2-4 weeks	4	1	
	Seasonal	6	2	**- 4**
	Permanent	0	0	
	Saturated only	90	97	
151	2-4 weeks	5	5	
	Seasonal	25	25	**0**
	Permanent	0	0	
	Saturated only	70	70	
138	2-4 weeks	15	5	
	Seasonal	40	60	**20**
	Permanent	25	20	
	Saturated only	20	15	
1055	2-4 weeks	5	1	
	Seasonal	2	4	**2**
	Permanent	0	0	
	Saturated only	93	95	
174	2-4 weeks	0	2	
	Seasonal	20	15	**- 5**
	Permanent	0	0	
	Saturated only	80	83	

ID #	Hydroperiod	%: Summer assessment	%: January assessment	Difference in est. of seasonal flooding
	Permanent	5	5	
	Saturated only	90	5	
255	2-4 weeks	0	0	
	Seasonal	5	10	**5**
	Permanent	45	50	
	Saturated only	50	40	
402	2-4 weeks	15	15	
	Seasonal	10	10	**0**
	Permanent	5	5	
	Saturated only	70	70	
385	2-4 weeks	1	0	
	Seasonal	5	30	**25**
	Permanent	0	0	
	Saturated only	94	70	

Appendix D4. Wetland Plants Documented From Island County, and Non-wetland Species Found In or Near Wetlands Visited in 2005

Comment: Limited time per site prohibited this study from being a comprehensive inventory of plants in each wetland or Countywide. The identifications have not been independently verified. A total of 103 sites were visited once and comprise a total area of at least 4454 acres, but in most cases only a portion of each wetland was searched, generally for less than 1 hour. In some cases the wetland was visited as late as November (see Appendix C3 for details).

Summary:

	# of IC Wetland Indicator Species* Found among 103 wetlands in 2005	% of IC Wetland Indicator Species Found	# of NON-wetland Species Found in 2005	Total Species Found in 2005	# of IC Wetland Indicator Species NOT Found
Woody Species	49	83%	7	56	10
Ferns	7	70%	4	11	3
Herbaceous Species	92	45%	42	134	114
Graminoids	46	58%	9	55	33
TOTAL	194	55%	62	256	160

* species classified by NWI as FAC, FACW, or OBL (not FAC-, FACU, NI, or unknown)

Notes for tables below:
Found in 2005: Only species that were present over at least 9 sq. ft. in a wetland are marked.
Associated w. wetlands: FAC= facultative, FACW= facultative wetland, FACU= facultative upland, NI= not a wetland indicator, OBL= obligate, 0= no information
Native: 1= yes, 0= no
Noxious: 2= on official list; 1= not on official list but considered invasive in some areas
Salt Tolerance: scale from 0= intolerant to 6= very tolerant, based mainly on author's experience
Bog Indicator: from list in Hruby (2004)

Part 1. Woody Species

Found in 2005	SciName	Associated w. wetlands	Native?	Noxious	Salt Tolerance	Bog Indicator
X	*Abies grandis*	FACU-	1		0	
X	*Acer circinatum*	FAC-	1		0	
X	*Acer macrophyllum*	FACU	1		0	
X	*Alnus rubra*	FAC	1		2	
X	*Amelanchier alnifolia*	FACU	1		0	
	Betula papyrifera	FAC	0		0	
	Betula pendula	FACW	0		0	
X	*Betula sp.*		0		0	
X	*Cornus sericea (stolonifera)*	FACW	1		2	
X	*Crataegus douglasii*	FAC	1		0	
X	*Crataegus monogyna*	FAC-	0		0	
X	*Cytisus scoparius*	0	0	2	0	
X	*Frangula (Rhamnus) purshiana*	FAC-	1		0	
X	*Gaultheria shallon*	FACU	1		0	
X	*Holodiscus discolor*	NI	1		0	
X	*Ilex aquifolium*	FACU	0		0	
X	*Kalmia microphylla (occidentalis)*	FACW+	1		0	X
X	*Ledum groenlandicum*	OBL	1		0	X

Found in 2005	SciName	Associated w. wetlands	Native?	Noxious	Salt Tolerance	Bog Indicator
X	*Lonicera involucrata*	FAC+	1		2	
X	*Mahonia (Berberis) aquifolium*	0	1		1	
X	*Mahonia (Berberis) nervosa*	FACU	1		0	
X	*Malus (Pyrus) fusca*	FACW	1		2	
	Morella (Myrica) californica	FACW	1		0	
X	*Myrica gale*	OBL	1		0	
X	*Oemleria cerasiformis*	FACU	1		0	
	Oplopanax horridus	FAC+	1		0	
X	*Physocarpus capitatus*	FACW-	1		2	
X	*Picea sitchensis*	FAC	1		1	
X	*Pinus contorta*	FAC	1		0	
X	*Pinus monticola*	FACU-	1		0	
X	*Polygonum cuspidatum*	FACU	0	1	0	
	Populus balsamifera (trichocarpa)	FAC	1		0	
X	*Populus tremuloides*	FAC+	1		0	
X	*Prunus emarginata*	FACU	1		0	
X	*Prunus virginiana*	FACU	1		0	
X	*Pseudotsuga menziesii*	FACU	1		0	
	Rhododendron macrophyllum	OBL	1		0	
	Rhododendron neoglandulosum	FACW+	1		0	
	Ribes bracteosum	FAC	1		0	
X	*Ribes divaricatum*	FAC	1		0	
X	*Ribes lacustre*	FAC+	1		0	
X	*Rosa eglanteria*	FACW	0		0	
X	*Rosa nutkana*	FAC	1	1	2	
X	*Rosa pisocarpa*	FAC	1		0	
X	*Rubus aremeniacus (discolor)*	FACU	0	1	2	
X	*Rubus laciniatus*	FACU+	0		2	
X	*Rubus lasiococcus*	NI	1		2	
X	*Rubus parviflorus*	FAC-	1		2	
X	*Rubus spectabilis*	FAC+	1		2	
X	*Rubus ursinus*	FACU	1		2	
X	*Salix geyeriana*	FACW+	1		0	
X	*Salix hookeriana (piperi)*	FACW	1		3	
X	*Salix lucida (lasiandra)*	FACW+	1		0	
	Salix prolixa (rigida)	OBL	1		0	
X	*Salix scouleriana*	FAC	1		0	
X	*Salix sitchensis*	FACW	2		0	
X	*Sambucus racemosa*	FACU	1		0	
X	*Spiraea douglasii*	FACW	1		0	
X	*Symphoricarpos albus*	FACU	1		0	
X	*Taxus brevifolia*	FAC-	1		0	
X	*Thuja plicata*	FAC	1		0	
X	*Tsuga heterophylla*	FACU-	1		1	
X	*Vaccinium oxycoccos*	OBL	1		2	X

Found in 2005	SciName	Associated w. wetlands	Native?	Noxious	Salt Tolerance	Bog Indicator
X	*Vaccinium ovatum*	0	1		2	
X	*Vaccinium parvifolium*	FACU	1		2	
	Vaccinium uliginosum	FACW+	1		2	

Part 2. Ferns and Their Allies

Found in 2005	SciName	Associated w. wetlands	Native?	Noxious	Salt Tolerance	Bog Indicator
	Adiantum aleuticum	FAC	1		0	
X	*Athyrium filix-femina*	FAC	1		2	
X	*Azolla mexicana*	OBL	1		0	
X	*Blechnum spicant*	FAC+	1		0	
	Botrychium multifidum	FAC	1		0	
X	*Dryopteris expansa*	FACU	1		0	
X	*Equisetum arvense*	FAC	1		2	
X	*Equisetum hyemale*	FACW	1		0	
X	*Equisetum telmateia*	FACW	1		0	
	Equisetum variegatum	FACW	1		0	
X	*Gymnocarpium dryopteris (disjunctum)*	FAC	1		0	
X	*Polypodium glycyrrhiza*	FACU	1		0	
X	*Polystichum munitum*	FACU	1		2	
X	*Pteridium aquilinum*	FACU	1		2	

Part 3. Herbaceous Species (except ferns and horsetails)

Found in 2005	SciName	Associated w. wetlands	Native?	Noxious	Salt Tolerance	Bog Indicator
X	*Abronia latifolia*	0	1		0	
X	*Achillea millefolium*	FACU	1		3	
	Agoseris elata	FAC	1		0	
	Alisma plantago-aquatica (triviale)	OBL	1		2	
X	*Allium cernuum*	NI	1		0	
X	*Ambrosia chamissonis*	0	1		0	
X	*Anaphalis margaritacea*	0	1		0	
	Angelica genuflexa	FACW	1		0	
	Angelica lucida	FAC+	1		2	
X	*Anthemis cotula*	FACU	0		0	
	Aquilegia formosa	FAC	1		0	
X	*Argentina egedii (Potentilla pacifica/anserina)*	OBL	1		4	
X	*Armeria maritima*	FAC	1		0	
	Atriplex hortensis	FAC	0		0	
X	*Atriplex patula*	FACW	1		6	
X	*Azolla mexicana*	OBL	1		0	
X	*Barbarea orthoceras*	FACW+	1		0	
	Bassia hyssopifolia	FACW	0		0	
	Berula erecta	OBL	1		0	
X	*Bidens cernua*	FACW+	1		2	
X	*Brassica rapa (campestris)*	0	0	1	0	
X	*Cakile edentula*	FACU	0	1	0	
X	*Callitriche heterophylla*	OBL	1		0	
X	*Caltha palustris (asarifolia)*	OBL	1		1	
	Calypso bulbosa	FAC+	1		0	

Found in 2005	SciName	Associated w. wetlands	Native?	Noxious	Salt Tolerance	Bog Indicator
X	*Calystegia (Convolvulus) soldanella*	NI	1		0	
	Camassia leichtlinii	FACW-	1		0	
	Camassia quamash	FACW	1		0	
	Cardamine breweri	FACW+	1		0	
	Cardamine oligosperma	FAC	1		0	
	Cardamine pensylvanica	FACW	1		0	
X	*Cardamine sp.*		1		0	
	Castilleja ambigua (Orthocarpus castillejoides)	FACW+	1		5	
X	*Centaurium erythraea (umbellatum)*	0	0		0	
X	*Ceratophyllum demersum*	OBL	1		0	
	Ceratophyllum echinatum	OBL	1		0	
	Chenopodium album	FAC	0	1	0	
X	*Chenopodium rubrum*	FACW+	1		0	
	Cicuta bulbifera	OBL	1		0	
X	*Cicuta douglasii*	OBL	1		3	
	Circaea alpina	FAC	1		0	
X	*Cirsium arvense*	FACU+	0	2	0	
X	*Cirsium vulgare*	FACU	0	2	0	
	Claytonia (Montia) parviflora	FACW-	1		0	
	Claytonia (Montia) perfoliata	FAC	1		0	
X	*Comarum palustre (Potentilla palustris)*	OBL	1		2	X
	Conioselinum gmelinii (pacificum)	FACW	1		0	
X	*Conium maculatum*	FAC+	0	2	0	
X	*Convolvulus arvensis*	0	0	2	0	
	Cornus unalaschkensis	FAC	1		0	
X	*Cotula coronopifolia*	FACW+	0		6	
X	*Cuscuta salina*	FACW	1		6	
	Daucus carota	FAC	0	1	0	
X	*Dipsacus fullonum (sylvestris)*	FAC	0	1	0	
	Dodecatheon pulchellum	FACW	1		0	
	Drosera rotundifolia	OBL	1		0	X
	Dulichium arundinaceum	OBL	1		0	
X	*Elodea canadensis*	OBL	1		0	
	Empetrum nigrum	FAC	1		0	X
X	*Epilobium ciliatum (watsonii)*	FACW-	1		0	
	Epilobium densiflorum (Boisduvalia densiflora)	FACW-	1		0	
X	*Frageria virginiana*	FACU	1		0	
	Fritillaria camschatcensis	FACW	1		0	
X	*Galium aparine*	FACU	1		3	
X	*Galium trifidum (cymosum)*	FACW+	1		1	
X	*Geum macrophyllum*	FACW-	1		0	
X	*Glaux maritima*	FACW+	1		5	
	Gnaphalium palustre	FAC+	1		0	
	Gnaphalium uliginosum	FAC+	0		0	
X	*Grindelia integrifolia*	FACW	1		6	
	Grindelia stricta	FACW	1		6	
X	*Hedera helix*	0	0	1	0	
X	*Heracleum lanatum (maximum)*	FAC+	1		1	
X	*Hippuris vulgaris*	OBL	1		0	
	Hydrophyllum tenuipes	FAC	1		0	
X	*Hypericum anagalloides*	OBL	1		0	

Found in 2005	SciName	Associated w. wetlands	Native?	Noxious	Salt Tolerance	Bog Indicator
X	*Hypochaeris radicata*	FACU	0	2	2	
X	*Impatiens noli-tangere*	FACW	1		0	
	Iris missouriensis	FACW+	1		0	
X	*Iris pseudacorus (repens)*	OBL	0	2	1	
	Isoetes lacustris	OBL	1		0	
X	*Jaumea carnosa*	OBL	1		6	
	Lactuca biennis	FAC	0		0	
X	*Lactuca muralis*	FAC	0		0	
X	*Lapsana communis*	0	0		0	
	Lasthenia minor	FAC	1		0	
X	*Lathyrus japonicus*	FACU-	1		2	
X	*Lathyrus latifolius*	0	0	1	0	
	Lathyrus palustris	OBL	1		3	
X	*Lemna minor*	OBL	1		0	
X	*Lemna trisulca*	OBL	1		0	
X	*Lemna turionifera*	OBL	1		0	
	Leontodon autumnalis	FAC	0		0	
X	*Lepidium densiflorum*	FAC-	1		0	
X	*Leucanthemum vulgare (Chrysanthemum leucanthemum)*	NI	0	2	0	
	Lilaeopsis occidentalis	OBL	1		5	
X	*Lotus corniculatus*	FAC	0		4	
X	*Ludwigia palustris*	OBL	1		0	
X	*Lupinus littoralis*	0	1		0	
X	*Lycopus americanus*	OBL	1		0	
X	*Lycopus uniflorus*	OBL	1		0	
X	*Lysichiton americanum*	OBL	1		1	
X	*Lythrum salicaria*	FACW+	0	2	3	
X	*Maianthemum (Smilacina) dilatatum*	FAC	1		2	
X	*Marah oreganus*	0	1		0	
X	*Matricaria discoidea (Chamomilla suaveolens)*	FACU	1		0	
X	*Mentha arvensis (canadensis)*	FACW-	1		1	
X	*Mentha spicata*	OBL	0		0	
X	*Menyanthes trifoliata*	OBL	1		0	X
	Mimulus alsinoides	OBL	1		0	
	Mimulus dentatus	OBL	1		0	
X	*Mimulus guttatus*	OBL	1		0	
	Mimulus moschatus	FACW+	1		0	
	Mitella pentandra	FAC	1		0	
	Montia fontana	OBL	1		0	
	Myosotis discolor	FACW	0		0	
X	*Myosotis laxa*	OBL	1		1	
	Myosotis scorpioides	FACW	0		0	
	Myosurus minimus (clavicaulis)	OBL	1		0	
	Myriophyllum aquaticum (brasiliense)	OBL	0		0	
X	*Myriophyllum sibiricum (spicatum)*	OBL	0	2	0	
	Najas flexilis	OBL	1		0	
	Nemophila pedunculata	FAC	1		0	
	Nepeta cataria	FAC	0		0	
X	*Nuphar lutea (polysepala)*	OBL	1		0	
	Nymphaea odorata	OBL	1		0	
X	*Oenanthe sarmentosa*	OBL	1		4	

Found in 2005	SciName	Associated w. wetlands	Native?	Noxious	Salt Tolerance	Bog Indicator
	Oenothera villosa (strigosa)	FAC+	0		0	
X	*Papaver argemone*	0	0		0	
X	*Parentucellia viscosa*	FAC-	0	1	0	
	Perideridia gairdneri	FAC	1		0	
	Petasites frigidus	FAC	1		0	
	Phyllospadix scouleri	OBL	1		0	
	Piperia (Habenaria) unalascensis	FAC	1		0	
	Plantago bigelovii	OBL	1		0	
X	*Plantago lanceolata*	FACU+	0		3	
X	*Plantago major*	FACU+	0		0	
X	*Plantago maritima*	FACW+	1		6	
	Platanthera (Habenaria) dilatata	FACW+	1		1	X
X	*Plectritis congesta*	FACU+	1		0	
X	*Polygonum amphibium (coccineum)*	OBL	1		0	
X	*Polygonum aviculare*	FACW-	1		0	
X	*Polygonum cuspidatum*	FACU	0		0	
	Polygonum douglasii (spergulariaeforme)(nuttallii)	FACW	1		0	
	Polygonum fowleri	FACW	1		0	
X	*Polygonum hydropiper*	OBL	0	1	0	
X	*Polygonum lapathifolium*	FACW	0	1	0	
X	*Polygonum persicaria*	FACW	0	1	0	
	Polygonum punctatum	OBL	1		0	
X	*Potamogeton amplifolius*	OBL	1		0	
X	*Potamogeton foliosus*	OBL	1		0	
	Potamogeton gramineus	OBL	1		0	
	Potamogeton illinoensis	OBL	1		0	
X	*Potamogeton natans*	OBL	1		0	
X	*Potamogeton praelongus*	OBL	1		0	
	Potamogeton richardsonii	OBL	1		0	
	Potamogeton zosteriformis	OBL	1		0	
	Potentilla gracilis	FAC	1		0	
	Pseudognaphlium stramineum (Gnaphalium chilense)	FAC+	1		0	
	Pyrola asarifolia	FACW-	1		0	
	Pyrola chlorantha	FAC	1		0	
	Ranunculus acris	OBL	0		0	
	Ranunculus cymbalaria	OBL	1		4	
	Ranunculus flammula	OBL	1		0	
X	*Ranunculus occidentalis*	FAC	1		0	
	Ranunculus orthorhynchus	FACW	1		0	
X	*Ranunculus repens*	FACW	0	1	2	
	Ranunculus sceleratus	FAC	0		0	
	Ranunculus trichophyllus (aquatilis)	OBL	1		0	
	Ranunculus uncinatus	FAC	1		0	
X	*Ricciocarpos natans*	OBL	1		0	
X	*Rorippa curvisiliqua*	OBL	1		0	
	Rorippa nasturtium-aquaticum (Nasturtium officinale)	OBL	1		0	
X	*Rorippa palustris*	OBL	1		0	
X	*Rumex aquaticus (occidentalis)*	FACW+	1		0	
X	*Rumex conglomeratus*	FACW	0		2	
X	*Rumex crispus*	FAC+	0	1	3	
X	*Rumex maritimus (persicarioides)*	FACW+	1		0	

Found in 2005	SciName	Associated w. wetlands	Native?	Noxious	Salt Tolerance	Bog Indicator
X	*Rumex salicifolius*	FACW	1		0	
X	*Ruppia maritima*	OBL	1		5	
	Sagina apetala	FAC	0		0	
	Sagina procumbens	FAC	0		0	
X	*Salicornia virginica*	OBL	1		6	
	Saxifraga cespitosa	FAC	1		0	
	Saxifraga ferruginea	FAC	1		0	
	Saxifraga nidifica (integrifolia)	FACW	1		0	
	Scutellaria galericulata	OBL	1		0	
X	*Scutellaria lateriflora*	FACW+	1		0	
X	*Senecio jacobaea*	FACU	0	2	0	
	Sidalcea hendersonii	FACW+	1		0	
	Silene menziesii	FAC	1		0	
	Sisyrinchium angustifolium	FACW-	1		0	
	Sisyrinchium californicum	FACW+	0		0	
	Sisyrinchium idahoense	FACW	1		0	
X	*Sium suave*	OBL	1		2	
X	*Solanum dulcamara*	FAC+	0		0	
X	*Solidago canadensis*	FACU	1		0	
X	*Sonchus asper*	FAC-	0	1	0	
X	*Sonchus oleraceus*	NI	0	1	0	
X	*Sparganium angustifolium (simplex)*	OBL	1		0	
X	*Sparganium emersum*	OBL	1		0	
X	*Sparganium eurycarpum*	OBL	1		0	
X	*Spergularia canadensis*	FACW	1		6	
	Spergularia diandra	FACW	0		0	
X	*Spergularia macrotheca*	FAC	1		6	
X	*Spergularia salina (marina)*	OBL	0	1	6	
	Spiranthes romanzoffiana	FACW	1		0	X
	Spirodela polyrhiza	OBL	1		0	
X	*Stachys chamissonis (cooleyae)*	FACW	1		0	
	Stachys mexicana	FACW	1		0	
X	*Stellaria crispa*	FAC+	1		0	
	Stellaria humifusa	OBL	1		5	
	Stellaria longipes	FACW-	0		0	
	Stuckenia (Potamogeton) pectinata	OBL	1		0	
	Suaeda calceoliformis (maritima)	FACW	1		6	
	Symphyotrichum (Aster) eatonii	FAC+	1		0	
X	*Symphyotrichum (Aster) subspicatus*	FACW	1		4	
X	*Taraxacum officinale (laevigatum)*	FACU	0	1	0	
X	*Tellima grandiflora*	NI	1		0	
X	*Tiarella trifoliata*	FAC-	1		0	
X	*Tolmiea menziesii*	FAC	1		0	
	Trientalis europaea (arctica)	OBL	1		0	
	Trifolium hybridum	FAC	0		3	
	Trifolium microcephalum	FAC	1		3	
X	*Trifolium pratense*	FACU	0		3	
X	*Trifolium repens*	FAC-	0	1	3	
	Trifolium variegatum	FAC	1		3	
	Trifolium wormskjoldii	FACW+	1		4	
X	*Triglochin maritima*	OBL	1		6	
	Typha angustifolia	OBL	1		5	
X	*Typha latifolia*	OBL	1		2	
X	*Urtica dioica*	FAC+	1		0	

Found in 2005	SciName	Associated w. wetlands	Native?	Noxious	Salt Tolerance	Bog Indicator
X	*Utricularia macrorhiza (vulgaris)*	OBL	1		0	
	Valerianella locusta	OBL	1		0	
X	*Veronica americana*	OBL	1		0	
	Veronica anagallis-aquatica	OBL	0		0	
	Veronica peregrina	OBL	1		0	
X	*Veronica scutellata*	OBL	1		0	
	Veronica serpyllifolia	FAC	0		0	
	Vicia americana	FAC	1		2	
X	*Vicia hirsuta*	NI	0		0	
X	*Vicia nigricans (gigantea)*	NI	1		3	
	Viola adunca	FACW-	1		0	
	Viola nephrophylla	FACW	1		0	
	Zigadenus venenosus	OBL	1		0	
X	*Zostera marina*	OBL	1		6	
X	*Zostera nana*	OBL	0		6	

Part 4. Graminoids (grasslike plants)

Found in 2005	SciName	Associated w. wetlands	Native?	Noxious	Salt Tolerance	Bog Indicator
X	*Agrostis capillaris (tenuis)*	FAC	0	1	0	
X	*Agrostis exarata*	FACW	1		0	
X	*Agrostis gigantea (alba)*	FAC	0		4	
X	*Agrostis stolonifera (alba)*	FAC	0	1	0	
X	*Alopecurus aequalis*	OBL	1		0	
X	*Alopecurus geniculatus*	OBL	1		1	
X	*Alopecurus pratensis*	FACW	0		1	
X	*Anthoxanthum odoratum*	FACU	0		2	
X	*Bromus sitchensis*	0	1		0	
X	*Calamagrostis canadensis*	FACW+	1		0	
	Carex aquatilis (sitchensis)	OBL	1		0	X
X	*Carex arcta*	OBL	1		0	
	Carex athrostachya	FACW	1		0	
	Carex aurea	FACW+	1		0	
	Carex canescens	FACW+	1		0	X
	Carex cusickii	OBL	1		0	
X	*Carex deweyana*	FACU	1		0	
X	*Carex exsiccata (vesicaria)*	OBL	1		0	
	Carex hoodii	FAC	1		0	
	Carex lasiocarpa	OBL	1		0	X
	Carex lenticularis	FACW+	1		0	
	Carex leptopoda	FAC	1		0	
X	*Carex lyngbyei*	OBL	1		5	
X	*Carex macrocephala*	FAC-	1		0	
	Carex macrochaeta	FACW-	1		0	
X	*Carex obnupta*	OBL	1		2	
	Carex ovalis (leporina)	FACW	1		0	
	Carex pachystachya	FAC	1		0	
	Carex pansa	FAC	1		0	

	Carex praticola	FACW	1		0	
X	*Carex stipata*	OBL	1		0	
X	*Carex tumulicola*	FACU	1		0	
	Carex utriculata (rostrata)	OBL	1		1	X
X	*Cinna latifolia*	FACW	1		0	
X	*Dactylis glomerata*	FACU	0	1	3	
X	*Deschampsia caespitosa*	FACW	1		5	
X	*Deschampsia elongata*	FACW-	1		0	
X	*Distichlis spicata (stricta)*	FAC+	1		6	
X	*Echinochloa crusgalli*	FACW	0	1	0	
X	*Eleocharis palustris*	OBL	1		4	
X	*Elymus (Elytrigia) (Agropyron) repens*	FAC-	1		3	
X	*Eriophorum chamissonis*	OBL	1		0	X
X	*Festuca rubra*	FAC+	0		4	
X	*Glyceria leptostachya*	OBL	1		0	
X	*Glyceria occidentalis*	OBL	1		0	
X	*Holcus lanatus*	FAC	0	1	2	
X	*Holcus mollis*	FACU	1		0	
X	*Hordeum brachyantherum*	FACW-	1		4	
	Hordeum depressum	FACW	1		0	
X	*Hordeum jubatum*	FAC-	1		5	
X	*Juncus acuminatus*	OBL	1		0	
X	*Juncus articulatus*	OBL	1		2	
X	*Juncus balticus (arcticus)*	FACW+	1		6	
	Juncus bolanderi	OBL	1		0	
	Juncus bufonius	FACW	1		2	
X	*Juncus effusus*	OBL	1		3	
X	*Juncus ensifolius (xiphioides)*	FACW	1		0	
X	*Juncus gerardii*	FACW+	1		5	
	Juncus lesueurii	FACW	1		3	
X	*Juncus tenuis*	FACW-	1		0	
X	*Leymus (Elymus) mollis*	FACU	1	1	4	
X	*Lolium arundinaceum (Festuca arundinacea)*	FAC-	0		4	
X	*Lolium perenne (multiflorum)*	FACU	0		4	
	Luzula parviflora	FAC-	1		0	
X	*Luzula sp.*		1		0	
X	*Phalaris arundinacea*	FACW	0	1	4	
	Phragmites australis (communis)	FACW+	0		3	
X	*Poa annua*	FAC	0	1	0	
	Poa palustris	FAC	1		0	
	Poa pratensis	FAC	0		3	
	Poa trivialis	FACW	0		0	
X	*Polypogon monspeliensis*	FACW	0	1	0	
	Puccinellia nutkaensis	OBL	1		0	
	Puccinellia nuttalliana (cusickii)	FACW+	1		0	
	Rhynchospora alba	OBL	1		0	
X	*Schoenoplectus acutus*	OBL	1		3	

X	*Schoenoplectus americanus*	OBL	1		4	
	Schoenoplectus atrocinctus	OBL	1		0	
X	*Schoenoplectus maritimus (robustus)*	OBL	1		5	
	Schoenoplectus pungens	OBL	1		0	
	Schoenoplectus subterminalis	OBL	1		0	
X	*Scirpus microcarpus*	OBL	1		2	
X	*Spartina alterniflora*	OBL	0	1	6	
X	*Spartina anglica*	OBL	0	1	6	
	Spartina densiflora	OBL	0	1	6	
	Spartina townsendii	OBL	0	1	6	
X	*Torreyochloa (Puccinellia) pauciflora*	OBL	1		0	
	Vulpia (Festuca) bromoides	FACW	0		0	

Appendix D5. Data Comparisons: Concurrence Rates Among Databases Used

Part 1. Wetland Type: Comparison of NWI and Field Observations

In 76 wetlands that were both mapped by NWI and visited by the ICPCD field crew during 2005, there was general concurrence regarding the class types and hydroperiod types present. Lack of concurrence could be due to NWI having to determine the classes only from aerial photographs, field crews being unable to access parts of a wetland clearly visible in airphotos, changes that occurred to a wetland since the time of the 1970s airphotos that NWI used for their maps, or the need for the NWI to generalize finer-scale features of wetlands when producing maps.

Table D5.1. Wetland Type: Comparison of NWI and Field Observations

	# of wetlands where NWI map codes show presence, but field observations imply absence	# of wetlands where field observations noted presence, but NWI map codes imply absence	# of wetlands where both sources imply absence	# of wetlands where both sources show presence
Emergent vegetation	1	30	1	44
Aquatic bed	5	36	25	10
Shrub or Forested	2	35	4	35
Saturated	0	0	73	3
Temporarily or Occasionally Flooded	3	43	25	5
Seasonally or Semipermanently Flooded	7	20	4	43
Permanently Flooded	5	17	19	33

Part 2. Vegetation Clearing: Comparison of Interpreted Airphotos, LiDAR, WDNR Timber Harvest Database, and Field Observations

In an attempt to estimate the completeness of various data sets, we compared their representations of vegetation clearing activities. These comparisons are not perfect because of differences in image quality, time periods, and data recording methods. In addition to the WDNR data set, the other sources we used were: (a) 1998-2005 change analysis using SPOT imagery, (b) 1985-1998 change analysis using aerial photographs, and (c) field visits. Results are compiled in the following tables.

Table D5.2. Vegetation clearing within wetlands: comparison of DNR timber harvest data and observations during 2005 wetland visits (n= 101)

	DNR authorized timber harvest in wetland	No DNR authorized timber harvest in wetland
Visited, and clearing noted	3	4
Visited, and no clearing noted	5	89

Table D5.3. Vegetation clearing within wetlands: comparison of DNR timber harvest data and interpreted 1998 airphoto image (n= 671)

	# of wetlands with DNR authorized timber harvest	# of wetlands with no DNR authorized timber harvest
Airphoto interpreted and clearing noted	3 (median %-cleared = 4%)	
Airphoto interpreted and no clearing noted	14 (median %-cleared = 74%)	223

Table D5.4. Vegetation clearing within wetlands: comparison of DNR timber harvest data and interpreted changes, 1998-2005, using SPOT image (n= 958)

	# of wetlands with DNR authorized timber harvest	# of wetlands with no DNR authorized timber harvest
SPOT change interpreted and clearing noted (only if first cleared between 1998-2005)	10	10
SPOT change interpreted and no clearing noted (only if first cleared between 1998-2005)	56	882

Table D5.5. Vegetation clearing within wetlands: comparison of field observations with interpreted changes, 1998-2005, using SPOT image (n= 958)

	# of wetlands with clearing noted in SPOT change analysis	# of wetlands with no clearing noted in SPOT change analysis
Visited, and recent clearing noted	1	13
Visited, and no recent clearing noted	19	925

In addition, permit files were reviewed. The field crew in summer 2005, during visits to 103 wetlands, noted vegetation clearing in 4 instances not evident from WDNR permit data. Possibly, that clearing was exempt from WDNR reporting requirements or occurred after the WDNR data were received. In 3 instances the field visits confirmed WDNR-permitted harvests.

Appendix D6. Summaries of Selected ICPCD Permit Applications That Involved Wetlands or Streams

Note: All descriptions are *very* general

022/04 CAA — Low impact[30]
Wetland #305

This application has two parts. First is to install a water potable water line through a Type 4 stream and its associated buffer to serve a proposed single family residence (permit not processed yet). Second is to build a wildlife viewing blind within the buffer of a Category A wetland. The applicant submitted a BSA addressing the project and proposing mitigation for the work to be done. The permit was approved per the BSA mitigation proposal and the usual BMP stipulations. The water line was done prior to the permit process. After the fact permit. Preparation for development.

050/04 CAA — Low to moderate impact
054/01 CAA — Wetland #255

There are four parts to this application. All of the parts involve restoration of native landscaping in or around wetland or stream buffers. Three parts also involved art sculptures and associated access and viewing paths. The applicant revised his proposal several times as solutions involving less impact on the buffers were sought. In the end we replaced crushed rock with mulch, reduced the number of walking stones in the buffer, and required all art to be at least 50 feet from the open water. Roughly 1500 sq ft will be permanently affected by walking areas (not including existing walking paths and art areas), which was reduced from the original plan to disturb close to 5000 sq ft. The project will restore between 64,000 to 69,000 sq ft of wetland buffer habitat and three years of monitoring. Of course all standard BMPs were required in areas where work was to be done. 054/01 CAA is for the first phase of the Earth Sanctuary sculpture installation and habitat restoration project. The trail access and sculptures created a 0.70-acre disturbance within the wetland buffer, and restored about 3.7 acres of wetland buffer as mitigation. We altered this project in many small ways to lessen its impact on the wetland buffer and an osprey nest on the property. These changes included rerouting access routes and limiting accessibility to the 300-foot buffer around the osprey nest during the nesting season. Restoration Purposes.

068/04 CAA — Low to moderate impact
394/04 CGP — Wetland #1.1023
394/03 SDP

This permit is for allowance of a well within a Category A wetland buffer. This is a beachfront parcel with a wetland on the back 1/3 of the parcel. The parcel can barely accommodate septic and a single family structure due to the 75 foot beachfront buffer for marine habitat (see 394/04 SDP), the 100 foot wetland buffer and all property setbacks. Therefore the only acceptable location for the well is in the wetland buffer. This will have the least impact of the three uses in the wetland, thus it is the most acceptable scenario for the County. Mitigation was required by the CGP that accompanies the project. 1500 square feet of buffer was disturbed to install the well. Replanting of native species on 5-foot center was required in this area. Monitoring for three years was also required. A short driveway (less than 60 feet) thought the wetland buffer was necessary to access the new SFR. The driveway was limited to 10 feet in width as it infringes on the wetland buffer. The modular home that was to be placed on the property required a 16-foot access to enable delivery. A temporary 16foot driveway was permitted until the home was completed. After the fact permit. Preparation for development.

180/04 CAA — Low impact
Wetlands #1005 & 1006

The applicant submitted a BSA describing her plan to demolish two dilapidated structures and restore the area to native vegetation. The BSA met all the CAO guidelines and the County approved the permit under the conditions that BMPs be used and an annual monitoring report be submitted to the County for three years following the restoration activities. Restoration Purposes.

091/04 CGP — No impact
213/04 ENV — Wetland #479.1213.1222

This is a permit to log roughly 16 acres of an 18-acre area which has wetlands at its east and west ends. The applicant understood the necessity for 100-foot buffers, and had indicated on his Clearing and Grading Site Plan that he would keep

[30] Degree of impact is simply based on a perceived amount of impact on the critical area. The degree of impact value is meant for reference purposes and is in no way intended for use in quantitative measurements.

all logging activity out of the buffers of the indicated wetlands. Upon our site visit, we noted that the border of the western wetland was improperly drawn, so we required the applicant to resubmit a site plan with the proper wetland edges and associated buffer. There was not a huge discrepancy and the applicant complied promptly. It was then discovered that the project was subject to SEPA review because the parcels were subdivided after 1960. The SEPA review was done through file 213/04 ENV. Preparation for development.

189/04 COV — Significant impact
Wetland #1002

Vegetation clearing resulted in partial impact to 11,800 sq ft of forested wetland and 18,400 sq ft of its associated buffer. A wetland delineation and a restoration plan were required, as well as the successful implementation of the plan and two years of monitoring. The landowner recently performed the restoration work. Preparation for development.

277/04 CGP — No impact
Wetland #1027

This is a permit to clear part of a property with wetlands and a stream. The applicant does not intend to clear or build near the ravine that contains a Type 4 stream and Category A wetland, and a site visit verified that that the footprint will not encroach any critical area buffers. The public comments indicated that there might be Pileated Woodpecker habitat on the property. No habitat was found by or Critical Areas Planner. No proposed clearing and grading boundaries needed to be altered. Preparation for development.

057/04 CGP — No impact
Wetland #358

This permit is to allow for enough tree removal and grading for a SFR and driveway. According to the critical areas map, the proposed home (and thus the clearing too) would have fallen within the 100-foot buffer of a Category A wetland. The applicant had a BSA performed and found that the wetland was smaller than the critical areas map indicated and the proposed home site did not fall within the buffer. Access/Roadwork for new development.

069/04 CGP — No impact
No Wetland

There was no wetland within the proposed clearing area. CAO had no affect on the planed development. Preparation for development.

010/04 CGP — Some impact
011/04 CGP — Wetland #1229

These two permits are for one logging project on two adjacent properties. The CAO had a large impact on the proposed forest practice activity in these permit applications. The applicant wanted to log the entire property (less roughly 1/8th of an acre in wetlands), but Pileated Habitat and extensive wetlands exist one or both properties, which limits the amount of land that can be cleared. The original applications showed the wetland boundaries incorrectly and did not indicate that there is Pileated habitat in the area. The County required a BSA, but the first edition of the BSA did not address the Pileated habitat correctly and a revised BSA was required; the revised BSA was accepted by the County. 1.03 acres of land were required to be left untouched for Pileated woodpecker habitat, 7,155 sq ft of which was mitigation for putting the access road through the prime Pileated habitat area and effectively connects the wetlands and the Pileated habitat. Additionally, 68,000 sq ft were designated off limits to clearing because of steep slopes in that area. The steep slopes were not properly addressed in the geologic report. This project was drastically modified because of the CAO. Preparation for development.

032/04 CGP — No impact
No known wetland nearby

The applicant wanted to log and grade enough of this property to build a SFR, guest house and a road to access these structures. A wetland and stream exist on the periphery of this parcel. The applicant was aware of the critical areas on his lot, and avoided any activity in their buffers. Preparation for development.

074/03 COV — Moderate impact
121/03 COV -- Concurrent warning to the contractor. — Wetland #1076

Owner cleared a driveway through a wetland buffer to access a site for a new SFR. A cease and desist order was issued, and subsequent design of SFR was altered to prevent further impact to the wetland buffer. The road and homesite ware moved about 15 feet to the north. No development has occurred since the violation. The restoration plan has no information about where the violation occurred on the property, so it is not possible to tell if the mitigation is happening in

the wetland or its buffer. It is unclear if the road was allowed to stay in the buffer. Roughly 2000 sq ft are being restored, but there is no documentation of how much land was disturbed. A three-year monitoring program was also required. The owner has been reminded to follow through with monitoring for two consecutive years. The restoration has been partially successful. The initial planting verification in May 2003 indicates that many plants were already dead or dying. Access/Roadwork for new development.

097/03 COV — Moderate impact
Wetland #1186

An enforcement order was issued to stop clearing and grading activities in a Category A wetland, its buffer and the buffer of a Type5 stream buffer. A restoration plan, including a description of how the fill will be removed from the wetland and a full planting inventory, was required (and submitted). Three years of monitoring was also called for. A fine of $2500 was issued. There are no records indicating how much the fine was reduced, nor how much was collected. The landowner called to tell the department that he had not finished the restoration planting in December 2003. This was 2 months after he was required to have the plants in the ground. There is no documentation of further follow up from either party since December 2003. Preparation for development.

083/04 CGP — Low impact
Wetland #237

This permit allowed for clearing and Grading in a Category A wetland. Two water tanks were installed less than 50 feet from the wetland (code specifies a 100-foot buffer), and a building was built 70 feet from the wetland. The original plan was to place these structures even closer to the wetland, but the applicant was required to move all structures away from the wetland as much as possible. The applicant was also required to submit a mitigation plan with his building permit (04-1008). This plan involves restoration of 3,400 sq ft of wetland buffer (removal of invasive species and planting of native species). This is roughly the same amount of buffer that was disturbed by the project. Utility/Roadwork for new development.

105/04 CGP — No impact on wetland
Wetland #63

The applicant wanted to thin several acres for forest health reasons and completely clear more land to build a SFR. Planning discovered more wetlands than the owner knew about upon the site visit. A wetland delineation was required as was a revision of the proposal based on the delineation results. The applicant removed about 2-1/2 acres from his proposed clearing area, and added about one acre on another part of the lot, for a total of roughly 1-1/2 acres removed from the proposal, presumably because wetland limitations. Preparation for development.

232/03 CGP — Moderate impact
Wetlands #1087.0.1 & 1087.0.2

In order for reasonable use of this property to occur, a driveway needed to be installed through a Category A wetland and a large part of its buffer to reach the developable land on the other side. The driveway could have disturbed less buffer, but the access permit the applicant already had secured forced the driveway through the wider portion of the wetland. A new access permit would have allowed for much less buffer disturbance. This driveway disturbs 5,600 sq ft of wetland a buffer. To mitigate for this impact, the applicant's BSA outlined an enhancement project in 5,600 sq ft of the remaining wetland and buffer. Planning accepted this mitigation measure and required a three-year monitoring of the new plantings. Another wetland stands on the backside of the property. This wetland's buffer forced the applicant not to disturb 25 – 50 sq ft of land than he had initially requested, but this requirement did not affect any building plans. Access/Roadwork for new development.

260/03 CGP — No impact
Wetland #276

The applicant wanted to clear enough area to build a SFR. An off-site wetland was found, and its buffer ran over the property line roughly 25 feet near the area to be cleared. The site maps are vague and have been altered a few times because of site access and septic issues, so it is difficult to tell if the wetland buffer affected the project. It did not affect the building plans, but it may have required the applicant to leave a few feet more of standing trees than he would otherwise have left. Preparation for development.

277/03 CAA — Potentially significant impact
Wetland #161

The Island County Department of Public Works submitted this permit to install a water leveling device in the wetland created at least in part by a beaver dam. The dam would back up enough water to flood nearby development. The leveling

device diverts any water over a certain elevation to the downstream portion of the stream (Type 4). The only mitigation required was to replace any plants that were inadvertently removed. No earthwork was to be done, but the usual siltation preventing measures was required. This project is a "utility," so it technically is a one time disturbance of the stream and its buffer, thus requires no restoration beyond the disturbed areas. It is arguable that this utility significantly disturbed several acres of upstream wetland by draining all water above the leveler. It also affected the downstream flow regime because it only lets water downstream at high water events (after significant rain). Mitigation for these impacts could have been considered. Flood control.

136/03 CAA Parcel: DOT Right of Way — Moderate impact
Wetland #35

This is a DOT application to improve an intersection at SR 20 and Sleeper road. The DOT is the lead agency, there is no County decision involved. The DOT is restoring a site at Frostad and Hoffman Roads (R1E, T33N, S13) as a mitigation measure. Utility/Roadwork.

452/03 CGP — No impact
Wetland #283

This is a CGP for two contiguous parcels on Grove Lake. The Clearing was well outside the lake's 100-foot buffer. Preparation for development.

107/03 CGP
392/03 COV
267/98 SHP — Moderate impact
Wetland #651

When the original parcel (R32925-096-1920) was divided into three smaller parcels, there was already a road through a Category A wetland. The owner applied for and was granted a CGP to clear enough area for two SFRs (the third parcel had a clearing already from before the SHP). The contracted logger cleared roughly 2/3 acre of area specifically labeled "no work of any kind in this area." This area contains a Type 4 stream and unstable slopes. The owner was issued a civil penalty and required to restore the areas that were cleared illegally. No restoration beyond the illegally disturbed area was conditioned (1:1 restoration to disturbance). The restoration is now complete and monitoring will continue for three years. Preparation for development.

178/03 CGP — No wetland impact
Wetland Unidentified

This CGP is to clear enough timber to build new roads through the identified parcels. The original site plan had the proposed roadbed running near a wetland, so the proposed road was moved so as to not pass through any wetland buffer. The road did have to cross a Type 4 stream, so a WDFW HPA was required. The HPA stipulated that all disturbed streambed and buffer that is not actually used for the road must be returned to pre-work conditions. No additional enhancement was necessary, and we required no stream buffer mitigation. Access/Roadwork for new development.

214/03 CGP — No impact
Wetland #235

The applicant has a wetland on site, but stayed well clear of the wetland and buffer. Preparation for development.

318/04 COV — Improvement
Wetland #324

A shed was built in the 100-foot buffer of a Category A wetland. The associated home was already built in the buffer under the reasonable use clause. Mitigation for building the shed in the buffer was required. A bio-swale was constructed to collect runoff from the shed's roof, and 1200 sq ft of native plants were planted in the wetland buffer, increasing the buffer size to 40 feet (up from <20 feet). 3 years of monitoring shall follow the installation. Preparation for development.

389/03 CGP — No impact
Wetland #246.1161

The applicant was approved to clear for a road that would serve as access to four future homesites. There is a wetland on the back portion of one of the parcels, but the clearing activity was not near the wetland or its buffer. The wetland was mapped and included as a feature on the parcel on which it exists. Any potential buyer of that parcel must be notified of the wetland and its buffer. Access/Roadwork for new development.

437/03 COV
100/96 BLA — Major impact
Wetland #398

231/04 CGP

The applicant imported 100 cubic yards of fill into a Category A wetland. About 7000 sq ft of wetland was filled. The applicant had completed a pre-application (920/03 PRE), so it was clear that they were aware of the regulations on the critical area when they began filling the wetland. The County required the fill to be removed, a mitigation plan to be written, implemented and then monitored for three years. This area will likely be filled because it is the only access to the proposed site for several new homes. The applicant also has a CGP application in process that seeks to allow the road under the reasonable use provision of the ICC. The road will allow access to the buildable property on the other side of the wetland. No other access is available. Access/Roadwork for new development.

090/02 CGP Improvement
726/00 COV Wetland #1094

This property was cleaned up from a near junkyard state under COV 726/00. The owner then proposed to create four clearings of roughly 1-½ acres each plus a total of five acres of view corridors. Wetlands throughout the property and a Type 3 stream on the eastern edge of the property limited the amount of clearing that could occur. In the end, one acre was cleared for a homesite and access to the site was allowed to be improved. Thus 9 ½ fewer acres were cleared than were originally proposed to be. This was a long and time consuming permit process because there were many issues with the land (violation, tax program, critical areas, applicant errors). The CAO altered the applicant's plans considerably. Much more land would have been cleared and more homes would have been built. Homes *can* still be built, but the applicant settled for one building site, presumably because the critical area restrictions made the process more complicated after an already prolonged permitting process. Preparation for development.

165/02 CGP No impact on wetland
Wetland #1054

The applicant had originally planned to clear and grade enough land to build a home and septic system and thin the remaining acreage of alders. A wetland exists on the property, so the wetland and its 100-foot buffer were required to remain untouched. This was fine with the applicant and the project moved forth as planned with the exception of the wetland areas, which were left alone. Preparation for development. The CAO modified this proposal minimally.

173/02 CGP Filled part of a wetland, major impact
Wetland #1248

Commercial project on Camano. 3500 sq ft of a Category A wetland was filled under the reasonable use criteria of the ICC. The entire western buffer of the wetland was paved over as well. Changes were made to the mitigation plan per a meeting with Planning, but no record of the changes required can be found in the file. The mitigation called for planting additional native plants in the remaining wetland on the lot (about 16000 sq ft) and an annual monitoring report for five years (with the 3rd and 5th years being more detailed). Mitigation increased plantings in remaining wetland, but no monitoring reports have been received, nor has the required As-Build. Preparation for development. A pre-application was done, so critical areas were addressed before the application was submitted.

150/02 COV Moderate impact
256/02 CGP Wetland #402

An enforcement order was issued in regard to clearing and grading that occurred in a small area of a wetland and 700 square feet within its buffer. An after the fact clearing and grading permit was required. All mitigation was to be covered through the CGP process, and 3 years of monitoring was required. The entire area that was cleared within the buffer was to be replanted per the mitigation plan. The landowner has been uncooperative through every step of the process and has not submitted follow up reports indicating the health of the mitigation plantings for the last two years. After the fact permit, preparation for development.

351/02 COV Moderate impact
Wetland #50

A cease and desist order was issued due to "concern regarding clearing and grading activity occurring on the site and its proximity to a regulated wetland." A restoration plan and three years of monitoring was required. The landowner needed many reminders to complete the planting and then to turn in monitoring reports. Monitoring is ongoing. Landowner needs goading to achieve compliance. 36,000 sq ft of disturbance was revegetated. Preparation for development

404/02 CGP No impact on critical areas
Wetland #351

This permit is to allow a COHP timber harvest of a 20-acre parcel and a long, narrow 1.4-acre parcel. The 1.4-acre parcel contains a forested wetland that bisects it. The wetland and its buffer were not touched, and the eastern side of the parcel

(about half of the parcel) was not logged because of the lack of access to the area. The applicant knew of the CAO restrictions. The original proposal showed the wetland and buffer and no clearing was proposed in this area. Preparation for development.

198/01 CGP — No impact on critical areas
Wetland #1131

This permit is to clear and grade most of an eighty-acre site so homes can be built. A forested wetland exists on the site. A 100-foot buffer was left around the wetland, which lies on the southwest portion of R32801-436-1630. Preparation for development

146/96 SHP — No action has been authorized, thus
338/02 COV — No impact has occurred
418/02 CGP — Wetland #1182

This is an ongoing project in Clinton where the owner wants to subdivide the 6.88-acre parcel into 4 buildable lots. There is a Category B wetland running north south through the center of the property, extending to the parcels to the north and south. Currently the wetland is completely engulfed by Himalayan blackberry. The owner is still working on meeting the County's requirements for the Short Plat. There is an associated COV and CGP related to some tree clearing on a steep slope in an area east of the wetland, out of the wetland buffer. Improvements to the wetland flora may be possible through granting the short plat. Preparation for development

247/01 CGP — No Impact
Wetland # 1077

This was a previously unmapped wetland and it continues onto the parcel just south (R23107-118-5220). No impact to the Category A wetland nor the Type 5 stream occurred due to this permit. The original delineation was unsatisfactory and Planning required the applicant to submit a new site plan with the proper wetland boundaries indicated. Just under ½ acre (21,250 square feet) of Category A wetland exist on the parcel. Preparation for development

109/02 CGP — No Impact
409/01 SHP — Wetland # 318

These permits were to clear and grade1.75 acres to build three homes on the parcel (through the associated short plat). The northern 0.33 acres of the property are in Category A wetland. The 100-foot buffer was respected and no impact to the wetland or its buffer occurred. Preparation for development

402/01 CGP Parcel: Public Right-of-way, Lost Lake — Wetland/Deepwater Habitat
Wetland #344.1089.0.2

Excavate 2,000 cubic yards (20,000 lineal feet) of soil to replace the water pipes in public right-of way by Lost Lake. The work happened at varying distances from the wetland/deepwater habitat. Strict erosion-control BMPs were required. Utility/Roadwork for new development.

224/03 CAA — Moderate impact
Wetland #1242.491

This permit is to allow 400 Cubic Yards of fill in Category A Wetland so the landowner could build a garage and boat garage. The lot is a small beach-community lot in the Utsalady RAID and also has a Type 4 stream on the north boundary of the parcel. Several hundred cubic yards of fill were already placed in 2400 square feet of the wetland in the past (date unknown). The new structures were built on the old fill, but additional fill was necessary to access the structures. The file contains a delineation. Preparation for development.

006/99 CGP — No Impact
291/01 SHP — Wetlands # 1024, 28, 587.1025 & 1026.644

There are 5 low quality wetlands on the 60 acres of land. The wetlands have been historically dredged and pooled for farm ponds. The parcels have been subdivided and the remaining trees cleared for single family residences. The clearing had no negative impact on the wetlands, the impact occurred long before the 1999 development. A delineation is in the CGP file and the Wetland file.

124/99 SHP — No Impact
435/95 WSR — Wetland # 374

No information on 435/95 WSR (Water System Review). The short-plat created three parcels and the wetland and its 25-foot buffer are shown on the face of the plat. All development has been restricted from the Category B wetland. A delineation was prepared for the project. Preparation for development.

149/99 CGP — Significant impact to buffer
Unmapped Category A Wetland

This is an after-the-fact permit for clearing and grading that was done to build a new single family residence. Approximately 7,200 square feet of a Category A buffer was disturbed. The landowner was required to restore the buffer with native plants. No restoration plan was submitted, but a stipulation in the permit was that a building permit could not be issued until the buffer was satisfactorily restored. Preparation for development.

188/99 CAA — Minor impact on buffer
212/96 SDP — Wetland # 416

Provide permanent access to a man-made infiltration pond through the buffer of a regulated Category B wetland. The filtration pond was constructed for the boat yard under 212/96 SDP, but access to the pond was not considered in that permitting review process. The next year when the pond needed maintenance, construction crews needed to move heavy equipment through the wetland buffer to access the pond. The heavy equipment caused significant rutting to the buffer. To allow future access to the pond, 188/99 CAA allowed a 145-foot road constructed of low-impact grass-grid road surface through the wetland. Access/Roadwork.

336/99 CAA — Moderate impact on Category A Wetland
317/99 SHP — Unmapped Wetland (waiting for final SHP map)
096/03 COV

The applicant is still completing the requirements for a short-plat of the parcel. Two moderate/severe violations have occurred around the Type 4 stream and associated Category A wetland in the riparian corridor of the stream. Portions of the buffer have been cleared up to 30 to the stream in the first violation. A 50-foot buffer was all that was required by the ICC at the time of the first violations (1999). The second violation saw the remainder of the buffer vegetation cleared to the soil. The short-plat map will show a required 50-foot buffer, but all subsequent development on the parcel will need to respect the 100-foot buffer now required by the ICC. Approximately 60,000 square feet of buffer was disturbed. Preparation for development.

362/99 CAA — Moderate Impact
Wetlands 263, 454, 453 and 576

The Washington Department of Transportation widened and improved State Route 525 between Fish and Honeymoon Bay Roads. Approximately 0.24 acres of existing in wetlands 263, 454 and 576 were affected by the roadwork. Approximately 0.39 acres of existing wetland number 453, a near-by wetland (one block south of SR 525 on Fish Road) was enhanced, with another 0.20-acres of buffer enhanced. An additional 0.29-acres of wetland were *created.* This is one of only two wetlands that were found during this review that were created as mitigation since the wetland protection rules were enacted n 1984. The file includes a BSA, but it is not specific, as are the wetland delineations. Access/Roadwork.

147/00 SHP — No impact
904/00 PRE — *New* Category A Wetland

A proposal to create a four-lot subdivision out of this eight-acre parcel. The proposal happened just prior to the parcel being rezoned from Rural Center to Rural. A minimal wetland delineation was performed. The project never came to fruition because of critical area, drainage and transportation concurrency regulations. Preparation for development.

180/00 CAA — Minor impact
Wetland #190

A new culvert was constructed under Burley Road to improve upland drainage. The outfall was moved further away from Burly Road, within 25' of the south edge of the Maxwelton wetland. The flow from the culvert was mitigated with quarry spoils and root wads of trees. The file contains a comprehensive BSA, which includes a wetland delineation. Utility/Roadwork.

208/00 CAA — Moderate impact
Wetland #334

This CAA allowed for a 33% buffer variance so that a culvert/swale could pass through the buffer of a Category A wetland. BMPs were required around the construction zone to prevent water quality problems in the wetland. The new drainage

feature is to improve drainage on the site so new condominiums could be built. Buffer averaging at a ratio of 2:1 was used and enhancement of the existing buffer was performed. Utility/Roadwork for new development.

231/00 CGP — Moderate impact
753/99 CGV (Clearing and Grading Violation) — Wetland #1238
753/99 CGV was a violation for placing a well within the wetland buffer. (Full file not found).
231/00 CGP is a permit to approve stream and wetland restoration after previous, non-permitted construction activities disturbed the wetland and Type IV stream. The road for which the culvert was installed to serve was allowed to remain, but the culvert was to be reconstructed for proper load and water-flow compatibility. Buffer reduction was necessary to accommodate the construction of a SFR as well as the road to access the SFR. A buffer reduction of 9,619 square feet was proposed and 20,243 square feet of buffer was set aside (a gain of 10,624 feet of buffer). Other buffer enhancements were also performed. Unpermitted stream culvert. After-the-Fact Permit. Preparation for development.

027/01 CAA — Significant impact
399/01 SHP — Wetland #1045
129/99 CGP
753/99 COV
For reasonable use purposes, the initial permit in this series, 129/99 CGP, allowed a driveway through the wetland under regulated conditions. The applicant did not abide by the conditions and placed a more fill in the wetland than was allowed. 753/99 COV was opened and an enforcement order was issued after the applicant failed to make significant attempts to bring the property into compliance with the CGP permit and CAO. The applicant complied by submitting a BSA and wetland mitigation/restoration plan. 150 plants were to be planted in the existing 14,270 square foot wetland, and a new wetland area was to be created by restricting water passage, thus inundating an additional 10,500 square feet of "wetted area." The original disturbance affected about half that area, 5,250 square feet. An additional 104 trees were planted in the buffer. The restoration activities were permitted through the CAA. The road through the wetland was allowed to remain where it was originally installed and mitigation for the violation was deemed acceptable according to the CAO. Access/Roadwork for new development.

250/01 CGP — No Action Taken/ No Impact
Wetland #447
The applicant applied for a CGP to improve drainage along a road through a wetland. His application was returned and he was instructed to apply for a CAA. The applicant did not apply for a CAA. Utility/Roadwork

254/01 CGP — No Action Taken/ No Impact
Wetlands #313 & 315
Proposed road and culvert through wetland and Chapman Creek. Applicant never met conditions required by staff and the file was closed. No work occurred on the site. Utility/Roadwork

100/02 CGP — Some Impact to wetland #1080
Import fill and reconstruct an access road/driveway through a Category A wetland to provide access to a new SFR. No other access was possible, Reasonable Use. No recorded delineation or mitigation/restoration plan. Affected area and amount of fill unknown. Utility/Roadwork to access new development.

104/02 SHP — Some Impact to wetland #1088
A short plat that created 4 parcels out of one 5.28 acre parcel. All the new lots are encumbered by the Category A wetland that runs north to south across the lots. A water line was run through the wetland to access the well site on the opposite side of the wetland from the proposed homesites. An additional 25% was added to the wetland buffer to mitigate for the waterline and the wetland and its increased buffers were drawn on the Short Plat. Utility/Roadwork for new development.

208/02 CGP — Significant Impact on Category B wetland
Wetland #1072
Clear, grade and import fill to construct an access road/driveway through a Category B wetland to provide access to a proposed SFR. A 90' long by 50' wide section of fill was allowed through the Category B wetland for the driveway. The applicant sold the property before any work was done and the new owner found a shorter path through the wetland. The second driveway proposal required only 12' by 20' of fill and was approved. Utility/Roadwork for new development.

Appendix D7. Percentiles and Other Statistical Summaries for Assessed Variables

Table D7.1. Characteristics of All Mapped Island County Wetlands

For explanation of the abbreviated names in the first column, see Appendix B. As an example of how to interpret data in this table, consider the characteristic, "AcContrib" and look in the last column ("90th"). The number 459.64 indicates that in less than 90% of the County's mapped wetlands, the acres in a wetland's Contributing Area is less than 459.64 acres, but in 10% of the wetlands it is more than this. The 50th percentile is the same as the median.

	Percentiles				
	10th	**25th**	**50th**	**75th**	**90th**
AB_NWI	0.00	0.00	0.00	0.00	1.00
Abnntv	0.00	0.00	0.00	0.00	0.00
AbnntvPct	0.00	0.00	0.00	0.00	0.48
Abntv	0.00	0.00	0.00	1.00	2.70
ABpctIC	0.00	0.00	1.00	5.00	30.00
Abspp	0.00	0.00	0.00	1.25	3.00
Abwetspp	0.00	0.00	0.00	1.00	3.00
AcContrib	1.66	6.98	31.48	143.67	459.64
AcresPoly	0.24	0.52	1.53	5.83	20.16
AirportAc	0.00	0.00	0.00	0.00	0.00
Algae	0.00	0.00	0.00	0.00	0.00
ArtifF_NWI	0.00	0.00	0.00	0.00	0.00
Avg_salsco	1.43	1.58	1.76	2.01	3.30
Avgwetscor	5.24	5.78	6.55	6.94	7.58
BaldEagle	0.00	0.00	0.00	0.00	1.00
Bare	0.00	0.00	0.00	0.00	0.00
BareEdgePct	0.00	0.00	0.00	1.00	10.00
BarePctIC	0.00	0.00	2.00	8.50	15.00
BEAVER	1.00	1.00	1.00	1.00	1.00
Beaver_NWI	0.00	0.00	0.00	0.00	0.00
BogStatus	0.00	0.00	0.00	0.00	0.00
BothWetAc	0.00	0.00	0.00	0.87	6.07
BothWetPct	0.00	0.00	0.00	23.26	52.90
BTpigeon	0.00	0.00	0.00	0.00	0.00
Burn	0.00	0.00	0.00	0.00	2.00
CavNestDucks	0.00	0.00	0.00	0.00	0.00
CDAac	0.00	0.00	0.00	0.00	0.00
Chaniz	0.00	0.00	0.00	0.00	0.00
ChlorideAvg	7.17	10.91	19.50	59.88	176.69
ChlorideMax	10.70	12.45	22.50	65.75	206.00
ClayDom	0.00	0.00	0.00	0.00	0.00
CommAgAc	0.00	0.00	0.00	0.00	0.00
Conduc	0.07	0.11	0.18	0.49	12.55
Crops	0.00	0.00	0.00	0.00	0.00
CTI	8.56	10.20	12.05	14.06	15.91
Curva	-0.67	-0.33	-0.11	0.00	0.11
DamNoWC	0.00	0.00	0.00	0.00	0.00
DamWC	0.00	0.00	0.00	0.00	2.00
DepthDryFlow	0.00	0.00	0.00	1.50	3.60
DepthDryStand	0.00	0.00	12.00	36.00	72.00
DepthWetFlow	2.00	3.00	5.00	12.00	25.00
DepthWetStand	3.00	12.00	36.00	72.00	98.40
DevelHiDen	0.00	0.00	0.00	0.36	8.18

	Percentiles				
	10th	**25th**	**50th**	**75th**	**90th**
DevelLoDen	0.00	0.00	0.00	5.74	18.79
DevelLoDenGrass	0.00	0.00	0.00	0.00	0.00
DevelLoDenSS	0.00	0.00	0.00	0.33	5.52
DFLY	1.00	1.00	1.00	1.00	1.00
Dike	0.00	0.00	0.00	0.00	2.00
Diked_NWI	0.00	0.00	0.00	0.00	0.00
DistBarn	45.50	71.25	112.50	200.00	720.00
DistComm	0.00	26.25	87.50	675.00	800.00
DistOthStruc	100.00	100.00	200.00	2325.00	3000.00
DistPermRes	40.00	100.00	150.00	275.00	500.00
DistSchool	40.00	40.00	107.50	268.75	300.00
DistSeasRes	40.00	50.00	100.00	250.00	340.00
Ditch	0.00	0.00	0.00	1.00	5.00
Ditched_NWI	0.00	0.00	0.00	0.00	0.00
DitchFt	0.00	0.00	0.00	0.00	0.00
Dom_wetnnt	0.00	0.00	0.00	1.00	1.00
Dom_wetntv	2.00	2.00	3.00	4.00	5.00
Dom_wetntvPct	0.51	0.75	0.83	1.00	1.00
Domavg_sal	1.35	1.61	2.00	2.33	4.59
Domavg_wet	5.60	6.50	7.33	8.19	9.23
Dommax_sal	2.00	2.00	3.00	4.00	6.00
Dommaxwets	8.00	10.00	10.00	10.00	10.00
Domnntv	0.00	0.00	0.00	1.00	1.00
DomnntvPct_	0.00	0.00	0.00	0.20	0.33
DomNox1	0.00	0.00	0.00	1.00	1.00
DomNox12	0.00	0.00	0.00	1.00	1.00
DomNox2	0.00	0.00	0.00	0.00	0.00
Domntv	1.40	3.00	3.00	4.50	5.00
Domspp	2.00	3.00	4.00	5.00	6.00
Domwet	2.00	3.00	4.00	5.00	6.00
DomwetPct	0.75	0.80	1.00	1.00	1.00
Downcut	0.00	0.00	0.00	0.00	0.00
Drain	0.00	0.00	0.00	0.00	0.00
Dscore	0.00	0.00	1.00	2.00	5.00
DscoreVegIncl	0.00	0.00	2.00	6.00	8.00
DUCKS	0.60	1.00	1.00	1.00	1.00
EAGLE	0.00	0.00	1.00	1.00	1.00
Elevation	20.99	88.88	164.33	263.91	346.84
Em_NWI	0.00	0.00	0.00	1.00	1.00
Emavgwetsc	5.57	6.24	6.83	7.50	8.11
Emnntv	0.30	1.75	3.00	4.25	6.00
EmnntvPct	0.02	0.10	0.17	0.23	0.31
Emntv	5.00	6.75	10.00	13.00	17.00
EmPctIC	15.00	25.00	50.00	77.50	90.00
Emspp	9.30	13.00	18.00	23.00	29.00
Emwetspp	6.30	9.75	13.00	16.00	23.00
EstuNWI	0.00	0.00	0.00	0.00	0.00
Excav	0.00	0.00	0.00	2.00	4.00
Excav_NWI	0.00	0.00	0.00	1.00	1.00
Fac_minus_	0.00	0.00	1.00	1.00	2.00
Fac_spp	1.00	3.00	4.00	6.00	7.00
Facplus_sp	1.00	2.00	2.00	3.00	4.00
Facu_minus	0.00	0.00	0.00	0.00	1.00

	Percentiles				
	10th	**25th**	**50th**	**75th**	**90th**
Facu_plus_	0.00	0.00	1.00	1.00	2.00
Facu_spp	1.00	3.00	4.00	5.00	7.70
Facw_minus	0.00	0.00	1.00	2.00	2.00
Facw_plus_	0.00	0.75	1.00	2.00	3.00
Facw_spp	1.00	2.00	3.00	4.25	6.00
FedLandAc	0.00	0.00	0.00	0.00	0.00
Fence	0.00	0.00	0.00	1.00	7.00
FillGrade	0.00	0.00	0.00	0.00	3.60
FishFt	0.00	0.00	0.00	0.00	145.50
FlatLiDAR	0.00	0.40	0.85	1.00	1.00
FlowAcc	83.61	418.06	2424.77	17788.61	124892.30
FO_NWI	0.00	0.00	0.00	0.00	0.10
ForestDecid	0.00	0.00	0.00	0.00	2.12
ForestEverg	0.00	0.00	0.00	0.00	1.28
ForestEvgrOpen	0.00	0.00	0.00	1.73	17.12
ForestMix	0.00	0.00	0.00	0.41	9.10
ForestOpenSS	0.00	0.00	0.00	0.00	4.76
ForestSSgrass	0.00	0.00	0.00	0.00	0.00
FROG	1.00	1.00	1.00	1.00	1.00
FyOpsAc	0.00	0.00	0.00	0.00	0.00
FyOpsPct	0.00	0.00	0.00	0.00	0.00
GeoAltExtent	0.00	0.00	0.05	0.20	0.50
GrassShort	0.00	0.00	4.97	20.48	39.28
GrassSparse	0.00	0.00	0.00	3.43	14.12
GrassUrban	0.00	0.00	0.00	1.53	7.79
GravelDom	0.00	0.00	0.00	1.00	1.00
Graz	0.00	0.00	0.00	4.00	9.60
GWhiAc	0.00	0.00	0.00	0.00	1.90
GWhiPct	0.00	0.00	0.00	0.01	75.90
GWloAc	0.00	0.00	0.00	0.53	4.69
GWloPct	0.00	0.00	0.00	29.35	99.19
GWmedAc	0.00	0.14	0.81	3.34	12.21
GWmedPct	0.00	16.42	88.24	100.00	100.00
GWsamp	0.00	0.00	0.00	0.00	0.00
HabEffect	12.40	18.00	21.00	25.00	27.60
HabWDOE	12.40	18.00	21.00	25.00	27.60
HarlequinD	0.00	0.00	0.00	0.00	0.00
HAWK	1.00	1.00	1.00	1.00	1.00
HERON	0.00	1.00	1.00	1.00	1.00
Hort	0.00	0.00	0.00	0.00	0.00
Hyd1_2NRCS	40.00	100.00	100.00	100.00	100.00
Hyd1pctNRCS	0.00	0.00	0.00	59.86	96.17
HydEffect	5.00	7.00	8.00	12.00	12.00
HydricDNRac	0.00	0.00	0.00	1.12	6.59
HydricDNRpct	0.00	0.00	0.00	56.52	97.74
HydWDOE	5.00	8.00	10.00	12.00	14.00
HypdPermPctIC	0.00	0.00	5.00	42.50	75.00
HypdSatPctIC	0.00	11.00	59.00	87.50	95.00
HypdSeasPctIC	0.00	2.00	7.00	25.00	40.00
HypdTempPctIC	0.00	0.00	3.00	5.00	10.00
I_PERM	0.00	0.00	0.00	1.00	1.00
ICacTot	0.00	0.16	1.02	4.92	17.03
IConlyAc	0.00	0.04	0.75	2.86	11.10

	Percentiles				
	10th	**25th**	**50th**	**75th**	**90th**
IConlyPct	0.00	3.97	68.00	100.00	100.00
ICpctTot	0.00	64.20	97.87	100.00	100.00
ImpervEdgePct	0.00	0.00	0.00	9.50	35.00
IndicChanHt	2.00	2.00	4.00	11.00	25.20
IndicStandHt	3.00	5.00	12.00	24.00	36.00
Intertidal_NWI	0.00	0.00	0.00	0.00	0.00
IntExp_NWI	0.00	0.00	0.00	0.00	0.00
InwetSum	0.00	0.00	0.00	0.00	1.00
LacusNWI	0.00	0.00	0.00	0.00	0.00
LakeFtDNR	0.00	0.00	0.00	0.00	0.00
LandfSoilDom	4.00	4.00	4.00	4.00	5.00
LawnEdgePct	0.00	0.00	0.00	5.00	30.00
LawnPast	0.00	0.00	0.00	3.00	7.00
LightMfgAc	0.00	0.00	0.00	0.00	0.00
LinearAlt	1.00	1.00	1.00	3.00	5.00
LoamDom	0.00	0.75	1.00	1.00	1.00
Logged	2.00	4.00	4.00	4.00	4.00
LogOthr	0.00	0.00	0.00	0.00	0.00
MadeLandPct	0.00	0.00	0.00	0.00	0.00
MatureFor	0.00	0.00	0.00	0.00	0.00
Max_salsco	4.00	4.00	4.00	6.00	6.00
MaxParcelsPerOwnr	1.00	1.00	1.00	2.00	3.00
Maxwetscor	10.00	10.00	10.00	10.00	10.00
MossPctIC	0.00	0.00	0.00	5.00	10.00
Mow	0.00	0.00	0.00	7.00	8.00
Mowed	0.00	0.00	0.00	0.00	0.00
MuckDom	0.00	0.00	0.00	0.00	0.00
MuckPeatPctAc	0.00	0.00	0.00	0.00	0.00
MunicAc	0.00	0.00	0.00	0.00	0.00
MUSKRAT	1.00	1.00	1.00	1.00	1.00
Native_spp	11.00	14.00	18.50	25.00	31.00
NewChange	0.00	0.00	0.00	0.00	0.00
NHPpctAllMax	0.00	0.00	0.00	0.00	0.00
NHPpctWetMax	0.00	0.00	0.00	0.00	0.00
NnABpc	0.00	0.00	0.00	0.00	5.00
NnEMpc	0.00	1.00	10.00	40.00	80.00
NnSSFOpc	0.00	0.00	2.00	5.00	20.00
No_change	0.00	0.00	1.00	1.00	1.00
NO3Avg	0.00	0.08	0.21	0.56	2.49
NO3Max	0.00	0.20	0.60	1.48	2.49
NoDomNox	1.00	3.00	4.00	5.00	5.00
NonHydric1NRCS	0.00	0.00	0.00	32.24	69.66
NonHydric2NRCS	0.00	0.00	0.00	0.00	22.64
NonHydricDNR	0.00	0.00	0.00	30.58	72.98
Nonnative_	1.00	3.00	6.00	9.00	12.70
NonnativePct	0.05	0.11	0.22	0.32	0.45
Nonntvdom	0.00	0.00	0.00	1.00	1.00
Nonntvwets	0.30	2.00	3.00	5.00	6.00
NotNox	13.00	16.75	21.00	27.25	33.70
Nox1	0.00	1.00	3.00	5.00	6.00
Nox12	1.00	2.00	4.00	7.00	8.00
Nox2	0.00	0.00	1.00	2.00	3.00
Ntvdom	2.00	3.00	3.00	5.00	5.00

	Percentiles				
	10th	**25th**	**50th**	**75th**	**90th**
Ntvwetspp	8.00	11.00	15.00	20.00	27.00
NtvwetsppPct	0.42	0.52	0.62	0.68	0.75
Num_spp	15.00	20.00	25.00	32.25	41.70
Num_strata	2.00	3.00	3.00	4.00	4.00
NumOwners	1.00	2.00	4.00	7.00	18.20
NumParcels	1.00	2.00	4.00	8.00	20.60
NumWetDown	1.00	1.00	2.00	4.00	5.00
NumWetUp	1.00	1.00	1.00	3.00	6.00
NWIacTot	0.00	0.00	0.41	2.05	8.51
NWIdiked	0.00	0.00	0.00	0.00	0.00
NWIditch	0.00	0.00	0.00	0.00	0.00
NWIexcav	0.00	0.00	0.00	1.00	1.00
NWInumClasses	0.00	0.00	1.00	1.00	2.00
NWInumCodes	1.00	1.00	1.00	1.00	2.00
NWInumHypds	1.00	1.00	1.00	1.00	2.00
NWIonlyAc	0.00	0.00	0.11	0.67	2.12
NWIonlyPct	0.00	0.00	2.13	35.80	100.00
NWIowPct	0.00	0.00	0.00	29.38	100.00
NWIpctTot	0.00	0.00	32.00	96.03	100.00
Obl_spp	2.00	4.00	6.00	9.00	12.00
Oblpct	0.09	0.18	0.24	0.33	0.42
OpenWater	0.00	0.00	0.00	0.00	0.00
OSPREY	0.00	0.75	1.00	1.00	1.00
Other_stat	0.00	0.00	1.00	2.00	4.00
OWL	1.00	1.00	1.00	1.00	1.00
OwnerNO	0.00	0.00	0.00	1.00	2.00
OwnerNoREP	0.00	1.00	2.00	4.00	10.80
OwnerYES	0.00	0.00	1.00	2.00	3.00
OWshallow	0.00	0.00	0.00	0.00	0.00
PalusNWI	1.00	1.00	1.00	1.00	1.00
ParcelNO	0.00	0.00	0.00	1.00	3.00
ParcelNoRep	0.00	1.00	3.00	5.00	14.00
ParcelsPerOwner	1.00	1.00	1.00	1.32	1.80
ParcelYES	0.00	0.00	1.00	2.00	4.00
ParkAc	0.00	0.00	0.00	0.00	0.00
PastureEdgePct	0.00	0.00	10.00	45.00	85.00
PctNatur	0.00	0.05	0.93	1.00	1.00
PeatDom	0.00	0.00	0.00	0.00	0.00
PeatPctAc	0.00	0.00	0.00	0.00	0.00
PermF_NWI	0.00	0.00	0.00	1.00	1.00
PermF2_NWI	0.00	0.00	0.00	0.00	0.00
PIWO	1.00	1.00	1.00	1.00	1.00
PlantOth	0.00	0.00	0.00	0.00	0.00
PondPct	0.00	0.00	0.00	0.05	0.50
Precip	23.00	27.00	29.00	31.00	35.00
RdFt0	0.00	0.00	0.00	0.00	0.00
RdFt1	0.00	0.00	0.00	0.00	0.00
RdFt11	0.00	0.00	0.00	0.00	0.00
RdFt14	0.00	0.00	0.00	0.00	0.00
RdFt2	0.00	0.00	0.00	0.00	0.00
RdFt3	0.00	0.00	0.00	0.00	0.00
RdFtSum	0.00	0.00	0.00	0.00	165.01
Refor	0.00	0.00	0.00	0.00	0.00

	Percentiles				
	10th	**25th**	**50th**	**75th**	**90th**
RevuDistAc	0.00	0.00	0.00	0.00	0.00
Riparian	0.00	0.00	0.00	0.00	0.00
RiparVeg	0.00	0.00	0.00	0.00	2.15
Riprap	0.00	0.00	0.00	0.00	0.00
Road	0.00	0.00	0.00	5.00	7.00
ROWcut	0.00	0.00	0.00	0.00	0.00
RuralAc	0.00	0.00	0.61	2.89	10.93
RuralAgAc	0.00	0.00	0.00	0.00	0.34
RuralCtrAc	0.00	0.00	0.00	0.00	0.00
RuralForestAc	0.00	0.00	0.00	0.00	0.00
RuralLawn	0.00	0.00	0.00	8.44	22.32
RuralResAc	0.00	0.00	0.00	0.00	0.26
RuralServAc	0.00	0.00	0.00	0.00	0.00
RuralVillAc	0.00	0.00	0.00	0.00	0.00
SALA	1.00	1.00	1.00	1.00	1.00
SALMO	1.00	1.00	1.00	1.00	1.00
SandCoarseDom	0.00	0.00	0.00	0.00	0.00
SandDom	0.00	0.00	0.00	0.00	1.00
SandFineDom	0.00	0.00	0.00	0.00	0.00
Satur_NWI	0.00	0.00	0.00	0.00	0.00
SBIRD	1.00	1.00	1.00	1.00	1.00
ScoreEffect	24.80	32.00	38.00	46.00	50.20
ScoreWDOE	28.00	36.00	45.00	53.00	63.00
SeabirdConc	0.00	0.00	0.00	0.00	0.00
SEAS	0.00	0.00	0.00	1.00	1.00
SeasF_NWI	0.00	0.00	0.00	1.00	1.00
SeasF2_NWI	0.00	0.00	0.00	0.00	0.00
SeasF3_NWI	0.00	0.00	0.00	0.00	0.00
SeasTidal_NWI	0.00	0.00	0.00	0.00	0.00
SedBarr	0.00	0.00	0.00	0.00	0.00
SedDepos	0.00	0.00	0.00	0.00	0.00
SemiF_NWI	0.00	0.00	0.00	0.00	0.00
SemipTidal_NWI	0.00	0.00	0.00	0.00	0.00
ShadedOW	0.00	5.00	30.00	87.50	100.00
ShorebConc	0.00	0.00	0.00	0.00	0.00
Shrub_wets	0.00	1.00	4.00	6.00	8.00
ShrubAgMix	0.00	0.00	0.00	6.97	29.39
Shrubavg_w	3.33	4.20	5.00	5.89	6.95
ShrubDecid	0.00	0.00	0.49	13.77	31.93
ShrubEvgr	0.00	0.00	0.00	4.47	13.74
ShrubForest	0.00	0.00	0.00	9.94	24.51
ShrubGrass	0.00	0.00	0.00	8.42	21.57
Shrubnntv	0.00	0.00	0.00	0.00	0.00
ShrubnntvPct	0.00	0.00	0.00	0.00	0.00
Shrubntv	0.00	1.00	4.00	6.00	7.00
Shrubspp	1.00	2.00	6.00	8.25	12.00
ShrubUrban	0.00	0.00	0.00	0.00	0.05
SideChanFtDNR	0.00	0.00	0.00	0.00	0.00
SiltDom	0.00	0.00	0.00	0.00	0.00
SlopeDEM	0.48	1.07	2.16	4.07	7.06
SlopeSoilDom	0.00	0.00	1.00	1.00	2.00
SoilDomPct	49.18	62.96	92.77	100.00	100.00
Spray	0.00	0.00	0.00	0.00	0.60

	Percentiles				
	10th	**25th**	**50th**	**75th**	**90th**
SS_NWI	0.00	0.00	0.00	1.00	1.00
Stormw	0.00	0.00	0.00	0.00	3.80
Stream1	0.00	0.00	0.00	0.00	0.00
Stream2	0.00	0.00	0.00	0.00	0.00
Stream3	0.00	0.00	0.00	0.00	0.00
Stream4	0.00	0.00	0.00	0.00	0.00
Stream5	0.00	0.00	0.00	0.00	0.00
StreamFt	0.00	0.00	0.00	0.00	497.13
Subtidal_NWI	0.00	0.00	0.00	0.00	0.00
Supratidal_NWI	0.00	0.00	0.00	0.00	0.00
SWsamp	0.00	0.00	0.00	0.00	0.00
TempF_NWI	0.00	0.00	0.00	0.00	1.00
TempTidal_NWI	0.00	0.00	0.00	0.00	0.00
Tide_annualPct	0.00	0.00	0.00	25.00	93.00
Tide_dayPact	0.00	0.00	1.00	10.00	62.00
Tide_ponded	0.00	0.00	0.00	0.00	42.00
Tillage	0.00	0.00	0.00	0.00	0.00
TOAD	1.00	1.00	1.00	1.00	1.00
Trail	0.00	0.00	0.00	0.00	7.00
TrashP	0.00	0.00	0.00	0.00	5.00
Tree_wetsp	0.00	1.00	2.00	3.00	4.00
Treenntv	0.00	0.00	0.00	0.00	0.00
TreenntvPct_	0.00	0.00	0.00	0.00	0.00
Treentv	0.00	1.00	2.00	3.00	4.00
Treespp	0.00	1.00	2.00	3.00	5.00
TreeSSpctIC	1.00	10.00	35.00	80.00	90.00
TURTLE	1.00	1.00	1.00	1.00	1.00
UB_NWI	0.00	0.00	0.00	1.00	1.00
UrbanNatOpenSp	0.00	0.00	0.00	0.00	0.00
US_NWI	0.00	0.00	0.00	0.00	0.00
VegAlt	0.00	0.00	0.20	0.80	1.00
VehTrax	0.00	0.00	0.00	0.00	5.00
WatColor	0.00	0.00	0.00	0.00	0.00
WaterEdgePct	0.00	0.00	0.00	0.00	0.00
WatPermPctIC	0.00	0.00	3.00	40.00	73.80
WatrRemov	0.00	0.00	0.00	0.00	0.60
WDOEcat	2.00	2.00	3.00	3.00	4.00
WetEmEst	0.00	0.00	0.00	0.00	0.00
WetEmForest	0.00	0.00	0.00	0.00	0.32
WetEmNonEst	0.00	0.00	0.00	0.03	5.11
WetEmSS	0.00	0.00	0.00	2.69	9.96
WetForest	0.00	0.00	0.00	0.00	1.47
WetPctCA	0.58	2.25	8.13	19.49	40.85
WetPctShed	0.01	0.02	0.07	0.35	1.25
WetShrub	0.00	0.00	0.00	1.37	7.23
WfowlConc	0.00	0.00	0.00	0.00	0.00
WoodDuck	0.00	0.00	0.00	0.00	0.00
WoodyEdgePct	5.00	20.00	60.00	90.00	99.20
WQ_WDOE	4.40	8.00	14.00	18.00	24.00
WQeffect	3.00	5.00	8.00	10.00	14.00

Table D7.2. Characteristics of the *surroundings* of all mapped Island County wetlands

For explanation of the abbreviated names in the first column, see Appendix B. For explanation of percentiles see Table D7.1.

	Percentiles				
	10th	**25th**	**50th**	**75th**	**90th**
AgComm100	0.00	0.00	0.00	0.00	0.00
AgComm150	0.00	0.00	0.00	0.00	0.00
AgComm300	0.00	0.00	0.00	0.00	0.00
AgComm50	0.00	0.00	0.00	0.00	0.00
AgRural100	0.00	0.00	0.00	0.00	22.87
AgRural150	0.00	0.00	0.00	0.00	24.73
AgRural300	0.00	0.00	0.00	0.00	25.57
AgRural50	0.00	0.00	0.00	0.00	21.06
Airpt100	0.00	0.00	0.00	0.00	0.00
Airpt150	0.00	0.00	0.00	0.00	0.00
Airpt300	0.00	0.00	0.00	0.00	0.00
Airpt50	0.00	0.00	0.00	0.00	0.00
Bare_025	0.00	0.00	0.00	10.00	48.00
Bare_100	0.00	0.00	0.00	5.00	24.50
Bare_150	0.00	0.00	0.00	1.00	16.00
Bare_50	0.00	0.00	0.00	5.00	20.00
Bare100	0.00	0.00	0.00	0.00	0.10
Bare150	0.00	0.00	0.00	0.00	0.54
Bare300	0.00	0.00	0.00	0.00	1.59
Bare50	0.00	0.00	0.00	0.00	0.00
Biglog_025	0.00	0.00	0.00	0.00	1.00
Biglog_100	0.00	0.00	0.00	0.00	1.00
Biglog_150	0.00	0.00	0.00	0.00	1.00
Biglog_50	0.00	0.00	0.00	0.00	1.00
Bigsnag_025	0.00	0.00	0.00	0.00	0.00
Bigsnag_100	0.00	0.00	0.00	0.00	0.00
Bigsnag_150	0.00	0.00	0.00	0.00	0.00
Bigsnag_50	0.00	0.00	0.00	0.00	0.00
Bigtree_025	0.00	0.00	0.00	0.00	1.00
Bigtree_100	0.00	0.00	0.00	1.00	1.00
Bigtree_150	0.00	0.00	0.00	1.00	1.00
Bigtree_50	0.00	0.00	0.00	1.00	1.00
BTPIac	0.00	0.00	0.00	0.00	0.00
CA_10lc98	0.00	0.00	1.39	2.71	4.52
CA_11lc98	0.00	0.00	0.77	1.61	2.83
CA_12lc98	0.00	0.00	0.00	0.00	0.01
CA_13lc98	0.00	0.00	0.00	0.00	0.12
CA_14lc98	0.00	0.00	0.00	0.06	0.42
CA_15lc98	0.00	0.00	0.00	0.00	0.00
CA_16lc98	0.00	0.00	0.00	0.34	0.87
CA_17lc98	0.00	0.00	2.26	5.45	10.01
CA_18lc98	0.00	1.18	4.49	8.47	13.48
CA_19lc98	0.00	0.00	0.00	0.59	1.30
CA_1LC98	0.00	0.00	0.52	1.91	4.89
CA_20lc98	0.00	0.88	2.65	4.06	6.40
CA_21LC98	0.00	0.00	0.00	0.70	2.17

	Percentiles				
	10th	25th	50th	75th	90th
CA_22lc98	0.00	0.00	0.85	2.48	5.32
CA_25lc98	0.00	0.00	1.01	2.98	6.22
CA_26lc98	0.00	0.00	0.00	0.35	1.57
CA_27lc98	0.00	1.02	5.25	10.61	17.57
CA_28lc98	0.00	3.24	8.61	17.41	29.80
CA_29lc98	0.00	0.00	3.35	10.06	21.87
CA_2LC98	0.00	1.42	3.72	7.10	12.14
CA_30lc98	0.00	0.00	0.00	1.40	4.35
CA_31lc98	0.00	1.46	3.95	7.46	11.02
CA_32lc98	0.00	3.70	10.45	17.54	24.22
CA_33lc98	0.00	0.00	0.00	0.00	0.00
CA_36lc98	0.00	0.00	0.00	0.00	0.26
CA_3lc98	0.00	0.00	0.00	0.00	0.56
CA_4lc98	0.00	0.00	1.19	4.58	9.91
CA_5lc98	0.00	0.00	0.45	1.15	2.36
CA_6lc98	0.00	0.00	0.00	0.64	2.55
CA_7lc98	0.00	0.00	2.21	5.09	8.28
CA_8lc98	0.00	0.00	4.58	16.23	27.07
CA_9lc98	0.00	0.00	0.29	0.85	1.60
CA_AgRuralPct	0.00	0.00	0.00	0.06	17.92
CA_CDApct	0.00	0.00	0.00	0.00	0.50
CA_CommAgPct	0.00	0.00	0.00	0.00	0.00
CA_ElevAvg	94.61	152.78	217.41	324.39	394.95
CA_ElevMax	141.14	214.98	298.48	414.72	478.47
CA_FedPct	0.00	0.00	0.00	0.00	0.00
CA_fy_EvenPct	0.00	0.00	0.00	2.14	8.12
CA_fy_ROWpct	0.00	0.00	0.00	0.00	0.00
CA_fy_SalvgPct	0.00	0.00	0.00	0.00	0.00
CA_fy_UnevenPct	0.00	0.00	0.00	0.00	2.85
CA_gwHiPct	1.22	4.99	16.25	50.30	96.71
CA_gwLoPct	1.17	5.26	22.37	58.82	89.16
CA_gwMedPct	25.25	52.91	83.81	100.00	100.00
CA_HydDNRpct	1.75	4.72	11.97	24.28	61.51
CA_HydNRCSpct	0.81	1.85	4.89	10.58	18.04
CA_LC98dom	0.00	0.00	0.00	0.00	0.00
CA_LC98pctDom	15.90	19.38	25.67	35.20	49.55
CA_LmfgPct	0.00	0.00	0.00	0.00	0.00
CA_madelandPct	0.00	0.00	0.00	0.00	0.00
CA_MunicPct	0.00	0.00	0.00	0.00	0.00
CA_parkPct	0.00	0.00	0.00	0.00	0.00
CA_precip	23.00	26.50	28.59	29.04	33.36
CA_rd0ft	0.00	0.00	0.00	0.00	0.00
CA_rd10ft	0.00	0.00	0.00	0.00	0.00
CA_rd11ft	0.00	0.00	0.00	835.86	3008.89
CA_rd13ft	0.00	0.00	0.00	0.00	0.00
CA_rd14ft	0.00	0.00	0.00	0.00	0.00
CA_rd1ft	0.00	0.00	44.09	1982.22	6536.13
CA_rd2ft	0.00	0.00	0.00	1111.36	4916.79
CA_rd3ft	0.00	0.00	0.00	0.00	656.14
CA_RevuDistPct	0.00	0.00	0.00	0.00	0.00
CA_roadft	0.00	0.00	839.16	5257.52	16075.51
CA_RurAirpPct	0.00	0.00	0.00	0.00	0.00
CA_RuralPct	0.00	44.55	84.25	100.00	100.00

	Percentiles				
	10th	**25th**	**50th**	**75th**	**90th**
CA_RurCtrPct	0.00	0.00	0.00	0.00	0.00
CA_RurForestPct	0.00	0.00	0.00	4.42	21.66
CA_RurResPct	0.00	0.00	0.00	0.00	13.09
CA_RurServPct	0.00	0.00	0.00	0.00	0.00
CA_RurVillPct	0.00	0.00	0.00	0.00	0.00
CA_SlopeAvg	4.52	6.09	8.44	11.76	16.25
CA_SlopeDom	0.00	1.00	1.00	1.00	2.00
CA_SlopeMax	17.07	24.23	39.10	59.89	80.32
CA_str1ft	0.00	0.00	0.00	0.00	0.00
CA_str3ft	0.00	0.00	0.00	0.00	129.41
CA_str4ft	0.00	0.00	0.00	1180.20	4688.09
CA_str5ft	0.00	0.00	0.00	2288.92	6421.16
CA_str9ft	0.00	0.00	227.61	2275.89	5518.37
CA_strFtSum	172.74	566.20	2206.62	6727.34	12513.45
Canopy_025	0.00	1.00	50.00	95.00	100.00
Canopy_100	0.00	0.00	22.50	90.00	100.00
Canopy_150	0.00	1.00	35.00	90.00	100.00
Canopy_50	0.00	0.00	55.00	95.00	100.00
CnestDuckAc	0.00	0.00	0.00	0.00	0.00
DevelHiDens100	0.00	0.00	0.00	1.95	10.25
DevelHiDens150	0.00	0.00	0.00	2.28	9.58
DevelHiDens300	0.00	0.00	0.00	2.96	7.84
DevelHiDens50	0.00	0.00	0.00	1.35	9.70
DevelLoDenGrass100	0.00	0.00	0.00	0.00	0.00
DevelLoDenGrass150	0.00	0.00	0.00	0.00	0.00
DevelLoDenGrass300	0.00	0.00	0.00	0.00	0.00
DevelLoDenGrass50	0.00	0.00	0.00	0.00	0.00
DevelLoDens100	0.00	0.00	2.25	7.99	14.97
DevelLoDens150	0.00	0.00	2.76	8.32	13.97
DevelLoDens300	0.00	0.52	3.54	7.85	12.79
DevelLoDens50	0.00	0.00	0.46	7.96	18.20
DevelLoDenSS100	0.00	0.00	0.00	3.13	9.75
DevelLoDenSS150	0.00	0.00	0.00	3.78	9.39
DevelLoDenSS300	0.00	0.00	0.63	4.17	7.97
DevelLoDenSS50	0.00	0.00	0.00	2.13	10.08
EAGLac	0.00	0.00	0.00	0.00	14.52
FedLand100	0.00	0.00	0.00	0.00	0.00
FedLand150	0.00	0.00	0.00	0.00	0.00
FedLand300	0.00	0.00	0.00	0.00	0.00
FedLand50	0.00	0.00	0.00	0.00	0.00
ForestDecid100	0.00	0.00	0.00	0.06	4.46
ForestDecid150	0.00	0.00	0.00	0.50	4.33
ForestDecid300	0.00	0.00	0.00	1.57	3.55
ForestDecid50	0.00	0.00	0.00	0.00	3.54
ForestEvgr100	0.00	0.00	0.00	0.00	1.89
ForestEvgr150	0.00	0.00	0.00	0.00	1.92
ForestEvgr300	0.00	0.00	0.00	0.01	2.30
ForestEvgr50	0.00	0.00	0.00	0.00	1.16
ForestEvgrOpen100	0.00	0.00	0.00	6.18	18.29
ForestEvgrOpen150	0.00	0.00	0.00	6.41	16.78
ForestEvgrOpen300	0.00	0.00	1.35	7.18	17.57
ForestEvgrOpen50	0.00	0.00	0.00	5.45	18.09
ForestMix100	0.00	0.00	0.00	3.53	9.69

	Percentiles				
	10th	**25th**	**50th**	**75th**	**90th**
ForestMix150	0.00	0.00	0.00	4.07	9.88
ForestMix300	0.00	0.00	1.21	4.97	9.68
ForestMix50	0.00	0.00	0.00	2.51	10.30
ForestOpenSS100	0.00	0.00	0.00	0.00	4.43
ForestOpenSS150	0.00	0.00	0.00	0.00	4.28
ForestOpenSS300	0.00	0.00	0.00	0.70	3.34
ForestOpenSS50	0.00	0.00	0.00	0.00	4.99
ForestSSgrass100	0.00	0.00	0.00	0.00	1.79
ForestSSgrass150	0.00	0.00	0.00	0.00	2.93
ForestSSgrass300	0.00	0.00	0.00	0.16	3.67
ForestSSgrass50	0.00	0.00	0.00	0.00	0.57
FyPct100	0.00	0.00	0.80	15.40	36.45
FyPct150	0.00	0.00	4.64	18.27	34.15
FyPct300	0.82	3.44	9.02	18.95	34.24
FyPct50	0.00	0.00	0.00	10.02	36.37
GrassShort100	0.00	0.43	9.84	21.59	34.81
GrassShort150	0.00	2.41	10.54	21.96	35.54
GrassShort300	0.39	3.81	10.35	19.85	32.09
GrassShort50	0.00	0.00	8.23	21.72	37.45
GrassSparse100	0.00	0.00	0.00	7.21	16.39
GrassSparse150	0.00	0.00	0.00	7.27	16.39
GrassSparse300	0.00	0.00	2.04	7.11	14.54
GrassSparse50	0.00	0.00	0.00	6.18	16.04
GrassUrban100	0.00	0.00	0.00	4.08	10.08
GrassUrban150	0.00	0.00	0.00	4.47	9.43
GrassUrban300	0.00	0.00	1.05	4.11	8.20
GrassUrban50	0.00	0.00	0.00	3.05	10.11
GrcovPct_025	0.00	0.00	5.00	10.00	30.00
GrcovPct_100	0.00	1.00	5.00	15.00	27.00
GrcovPct_150	0.00	1.00	5.00	13.00	23.80
GrcovPct_50	0.00	1.00	5.00	15.00	40.00
GWhi100	0.00	0.00	0.00	5.95	65.97
GWhi150	0.00	0.00	0.00	9.37	62.19
GWhi300	0.00	0.00	0.00	15.26	58.53
GWhi50	0.00	0.00	0.00	2.37	66.32
GWlo100	0.00	0.00	0.00	27.91	77.17
GWlo150	0.00	0.00	0.00	28.61	73.63
GWlo300	0.00	0.00	0.35	26.87	65.91
GWlo50	0.00	0.00	0.00	27.91	84.61
GWmid100	0.00	34.45	77.53	100.00	100.00
GWmid150	0.00	38.09	75.08	100.00	100.00
GWmid300	9.59	38.85	73.27	100.00	100.00
GWmid50	0.00	29.35	81.73	100.00	100.00
HydDNR100	0.00	7.49	28.48	55.46	99.99
HydDNR150	0.00	8.52	25.85	50.70	98.28
HydDNR300	2.21	8.59	21.20	43.74	80.96
HydDNR50	0.00	4.56	33.91	63.69	100.00
Imperv_025	0.00	0.00	0.00	0.00	18.00
Imperv_100	0.00	0.00	0.00	0.00	35.00
Imperv_150	0.00	0.00	0.00	0.25	21.00
Imperv_50	0.00	0.00	0.00	0.00	25.00
Lawn_025	0.00	0.00	0.00	0.00	77.00
Lawn_100	0.00	0.00	0.00	2.25	70.00

	Percentiles				
	10th	**25th**	**50th**	**75th**	**90th**
Lawn_150	0.00	0.00	0.00	20.00	75.50
Lawn_50	0.00	0.00	0.00	0.00	76.00
LiteMfg100	0.00	0.00	0.00	0.00	0.00
LiteMfg150	0.00	0.00	0.00	0.00	0.00
LiteMfg300	0.00	0.00	0.00	0.00	0.00
LiteMfg50	0.00	0.00	0.00	0.00	0.00
MatureAc	0.00	0.00	0.00	0.00	0.00
Mowed100	0.00	0.00	0.00	0.00	0.00
Mowed150	0.00	0.00	0.00	0.00	0.00
Mowed300	0.00	0.00	0.00	0.00	0.64
Mowed50	0.00	0.00	0.00	0.00	0.00
Municip100	0.00	0.00	0.00	0.00	0.00
Municip150	0.00	0.00	0.00	0.00	0.00
Municip300	0.00	0.00	0.00	0.00	0.00
Municip50	0.00	0.00	0.00	0.00	0.00
NatGcov_025	10.00	42.50	87.50	100.00	100.00
NatGcov_100	0.00	36.25	87.50	100.00	100.00
NatGcov_150	0.00	31.25	90.00	100.00	100.00
NatGcov_50	0.00	50.00	90.00	100.00	100.00
NnatvPct_025	1.00	4.50	15.00	60.00	85.00
NnatvPct_100	0.00	4.25	20.00	50.00	80.00
NnatvPct_150	0.00	5.00	20.00	50.00	80.90
NnatvPct_50	0.00	3.00	20.00	50.00	80.00
Nnsp_20__100	0.00	0.00	0.00	1.00	1.00
Nnsp_20__150	0.00	0.00	0.00	1.00	1.00
Nnsp_20_025	0.00	0.00	0.00	1.00	1.00
Nnsp_20_50	0.00	0.00	0.00	1.00	1.00
NoxPct_025	0.00	0.00	1.00	2.50	5.00
NoxspPct_100	0.00	0.00	1.00	1.00	5.00
NoxspPct_150	0.00	0.00	1.00	1.00	5.00
NoxspPct_50	0.00	0.00	1.00	2.00	5.00
OpenWater100	0.00	0.00	0.00	0.00	0.00
OpenWater150	0.00	0.00	0.00	0.00	0.00
OpenWater300	0.00	0.00	0.00	0.00	0.00
OpenWater50	0.00	0.00	0.00	0.00	0.00
OWshallow100	0.00	0.00	0.00	0.00	0.00
OWshallow150	0.00	0.00	0.00	0.00	0.00
OWshallow300	0.00	0.00	0.00	0.00	0.35
OWshallow50	0.00	0.00	0.00	0.00	0.00
Park100	0.00	0.00	0.00	0.00	0.00
Park150	0.00	0.00	0.00	0.00	0.00
Park300	0.00	0.00	0.00	0.00	0.00
Park50	0.00	0.00	0.00	0.00	0.00
RdFt100	0.00	0.00	123.61	279.90	563.84
RdFt150	0.00	51.42	144.87	253.36	525.94
RdFt300	203.33	339.42	527.51	812.64	1442.83
RdFt50	0.00	0.00	0.00	191.59	430.38
RevuDist100	0.00	0.00	0.00	0.00	0.00
RevuDist150	0.00	0.00	0.00	0.00	0.00
RevuDist300	0.00	0.00	0.00	0.00	0.00
RevuDist50	0.00	0.00	0.00	0.00	0.00
RiparNHPac	0.00	0.00	0.00	0.00	0.00
RiparVeg100	0.00	0.00	0.00	0.00	1.96

	Percentiles				
	10th	25th	50th	75th	90th
RiparVeg150	0.00	0.00	0.00	0.00	1.77
RiparVeg300	0.00	0.00	0.00	0.02	1.85
RiparVeg50	0.00	0.00	0.00	0.00	2.16
Rural100	0.00	11.30	89.51	100.00	100.00
Rural150	0.00	19.38	81.77	100.00	100.00
Rural300	0.00	27.04	75.83	100.00	100.00
Rural50	0.00	4.65	99.87	100.00	100.00
RuralCtr100	0.00	0.00	0.00	0.00	0.00
RuralCtr150	0.00	0.00	0.00	0.00	0.00
RuralCtr300	0.00	0.00	0.00	0.00	0.00
RuralCtr50	0.00	0.00	0.00	0.00	0.00
RuralForest100	0.00	0.00	0.00	0.00	9.10
RuralForest150	0.00	0.00	0.00	0.00	14.02
RuralForest300	0.00	0.00	0.00	0.00	18.24
RuralForest50	0.00	0.00	0.00	0.00	1.82
RuralLawn100	0.00	0.00	3.82	10.71	18.78
RuralLawn150	0.00	0.00	4.55	10.39	18.06
RuralLawn300	0.00	1.92	5.17	10.22	15.63
RuralLawn50	0.00	0.00	1.70	10.70	20.02
RuralRes100	0.00	0.00	0.00	0.00	33.79
RuralRes150	0.00	0.00	0.00	0.00	34.14
RuralRes300	0.00	0.00	0.00	0.00	36.59
RuralRes50	0.00	0.00	0.00	0.00	28.39
RuralServ100	0.00	0.00	0.00	0.00	0.00
RuralServ150	0.00	0.00	0.00	0.00	0.00
RuralServ300	0.00	0.00	0.00	0.00	0.00
RuralServ50	0.00	0.00	0.00	0.00	0.00
RuralVill100	0.00	0.00	0.00	0.00	0.00
RuralVill150	0.00	0.00	0.00	0.00	0.00
RuralVill300	0.00	0.00	0.00	0.00	0.00
RuralVill50	0.00	0.00	0.00	0.00	0.00
SbirdAc	0.00	0.00	0.00	0.00	0.00
ShedAgPct	3.72	8.43	19.26	23.69	44.27
ShedDevPct	10.37	12.81	19.63	28.71	43.31
ShedFyPct	1.82	2.37	3.58	5.13	8.81
ShedPockEstu	0.00	0.00	1.00	1.00	1.00
ShedRdDens	28.43	31.52	35.32	47.29	58.04
ShedRisk	0.15	0.25	0.48	0.66	0.94
ShedSalmo	0.00	0.00	0.00	0.00	1.00
ShrubAgMix100	0.00	0.00	0.00	12.54	27.18
ShrubAgMix150	0.00	0.00	1.13	13.15	26.38
ShrubAgMix300	0.00	0.00	3.15	12.41	24.89
ShrubAgMix50	0.00	0.00	0.00	11.23	26.53
ShrubDecid100	0.00	0.00	5.55	16.67	28.09
ShrubDecid150	0.00	0.00	6.32	16.55	27.37
ShrubDecid300	0.00	1.14	7.52	16.10	24.40
ShrubDecid50	0.00	0.00	3.87	16.23	28.22
ShrubEvgr100	0.00	0.00	1.06	7.24	13.38
ShrubEvgr150	0.00	0.00	2.13	7.42	12.78
ShrubEvgr300	0.00	0.00	3.13	7.24	11.99
ShrubEvgr50	0.00	0.00	0.00	6.53	13.95
ShrubForest100	0.00	0.00	2.48	10.86	21.66
ShrubForest150	0.00	0.00	2.93	11.18	20.35

	Percentiles				
	10th	25th	50th	75th	90th
ShrubForest300	0.00	0.06	4.16	10.77	17.93
ShrubForest50	0.00	0.00	1.30	10.88	23.47
ShrubGrass100	0.00	0.00	0.89	7.88	17.11
ShrubGrass150	0.00	0.00	1.84	7.86	14.92
ShrubGrass300	0.00	0.00	2.43	6.80	12.26
ShrubGrass50	0.00	0.00	0.00	8.36	20.01
ShrubUrban100	0.00	0.00	0.00	0.00	2.28
ShrubUrban150	0.00	0.00	0.00	0.00	2.88
ShrubUrban300	0.00	0.00	0.00	0.39	3.67
ShrubUrban50	0.00	0.00	0.00	0.00	1.07
Slope_025	1.00	3.00	8.00	17.00	26.00
Slope_100	-2.30	1.00	5.00	11.00	23.60
Slope_150	-2.30	1.00	4.00	9.75	20.00
Slope_50	-3.00	1.00	5.00	13.00	30.00
WatPct_025	0.00	0.00	0.00	0.00	5.80
WatPct_100	0.00	0.00	0.00	0.00	25.00
WatPct_150	0.00	0.00	0.00	0.00	27.00
WatPct_50	0.00	0.00	0.00	0.00	11.00
Watr_025	0.00	0.00	0.00	0.00	4.50
Watr_100	0.00	0.00	0.00	0.00	0.00
Watr_150	0.00	0.00	0.00	0.00	0.00
Watr_50	0.00	0.00	0.00	0.00	0.00
WduckAc	0.00	0.00	0.00	0.00	0.00
WetEmEst100	0.00	0.00	0.00	0.00	0.00
WetEmEst150	0.00	0.00	0.00	0.00	0.00
WetEmEst300	0.00	0.00	0.00	0.00	0.00
WetEmEst50	0.00	0.00	0.00	0.00	0.00
WetEmForest100	0.00	0.00	0.00	0.00	1.35
WetEmForest150	0.00	0.00	0.00	0.00	1.40
WetEmForest300	0.00	0.00	0.00	0.00	1.79
WetEmForest50	0.00	0.00	0.00	0.00	0.56
WetEmNonEst100	0.00	0.00	0.00	1.31	5.68
WetEmNonEst150	0.00	0.00	0.00	1.84	5.61
WetEmNonEst300	0.00	0.00	0.04	2.12	3.86
WetEmNonEst50	0.00	0.00	0.00	0.60	5.40
WetEmSS100	0.00	0.00	0.10	5.20	9.42
WetEmSS150	0.00	0.00	0.41	5.00	8.82
WetEmSS300	0.00	0.01	2.07	4.55	7.42
WetEmSS50	0.00	0.00	0.00	4.09	11.61
WetForest100	0.00	0.00	0.00	0.00	1.95
WetForest150	0.00	0.00	0.00	0.00	2.05
WetForest300	0.00	0.00	0.00	0.83	2.78
WetForest50	0.00	0.00	0.00	0.00	1.59
WetlandNHPac	0.00	0.00	0.05	0.83	2.11
WetShrub100	0.00	0.00	0.00	2.50	6.90
WetShrub150	0.00	0.00	0.00	2.67	6.21
WetShrub300	0.00	0.00	0.91	3.19	5.65
WetShrub50	0.00	0.00	0.00	1.94	7.51
WfowlAc	0.00	0.00	0.00	0.00	0.00
WoodPct_025	1.90	20.00	50.00	90.00	99.10
WoodPct_100	5.00	15.00	50.00	85.00	95.60
WoodPct_150	5.00	20.00	45.00	80.00	95.00
WoodPct_50	1.90	10.00	46.00	86.25	98.10

Table D7.3. Wetlands That Were Altered Between 1985 and 1998: Their Characteristics

For explanation of the abbreviated names in the first column, see Appendix B. For explanation of percentiles see Table D7.1.

	No Apparent Change 1985-1998					Changed 1985-1998				
	10th	25th	50th	75th	90th	10th	25th	50th	75th	90th
AB_NWI	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	1.00
Abnntv	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AbnntvPct	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0.00	0.00	0.00
Abntv	0.00	0.00	0.00	1.00	2.00	0.00	0.00	0.00	1.50	3.90
ABpctIC	0.00	0.00	1.00	6.00	30.00	0.00	0.00	0.00	3.00	70.00
Abspp	0.00	0.00	0.00	1.00	3.00	0.00	0.00	0.00	1.50	3.90
Abwetspp	0.00	0.00	0.00	1.00	2.40	0.00	0.00	0.00	1.50	3.90
AcContrib	1.70	6.54	28.96	142.13	440.73	1.31	18.71	57.54	219.92	948.64
AcresPoly	0.23	0.51	1.40	4.88	16.85	0.37	1.17	5.15	18.51	61.51
Air_Li	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AirportAc	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Algae	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ArtifF_NWI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Avg_salsco	1.43	1.58	1.76	2.00	3.21	1.39	1.47	1.65	1.78	2.19
Avgwetscor	5.21	5.77	6.52	6.90	7.52	5.18	5.68	6.39	6.91	7.53
BaldEagle	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	1.00
Bare	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22
BareEdgePct	0.00	0.00	0.00	1.00	10.00	0.00	0.00	0.00	0.00	0.00
BarePctIC	0.00	0.00	2.00	10.00	15.00	0.00	0.00	2.00	5.00	15.00
Bdg_Li	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BEAVER	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
Beaver_NWI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Berm_Li	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BogStatus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BothWetAc	0.00	0.00	0.00	0.66	4.82	0.00	0.00	0.37	3.08	13.55
BothWetPct	0.00	0.00	0.00	22.16	52.81	0.00	0.00	2.65	29.44	49.37
BTPI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
BTpigeon	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Burn	0.00	0.00	0.00	0.00	1.60	0.00	0.00	0.00	1.00	3.00
CA_10lc98	0.00	0.00	1.32	2.64	4.54	0.00	0.45	1.79	2.89	4.25
CA_11lc98	0.00	0.00	0.72	1.62	2.86	0.00	0.00	0.99	1.59	2.27
CA_12lc98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
CA_13lc98	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.30
CA_14lc98	0.00	0.00	0.00	0.04	0.41	0.00	0.00	0.00	0.17	0.59
CA_15lc98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
CA_16lc98	0.00	0.00	0.00	0.33	0.85	0.00	0.00	0.04	0.46	1.24
CA_17lc98	0.00	0.00	2.18	5.46	10.25	0.00	1.04	2.90	5.42	8.76
CA_18lc98	0.00	1.12	4.40	8.18	13.11	1.05	3.50	6.79	10.59	15.81
CA_19lc98	0.00	0.00	0.00	0.60	1.35	0.00	0.00	0.12	0.56	0.87
CA_1LC98	0.00	0.00	0.50	1.77	4.88	0.00	0.00	1.04	2.34	5.74
CA_20lc98	0.00	0.79	2.54	4.04	6.40	0.00	1.12	3.06	4.06	5.38
CA_21LC98	0.00	0.00	0.00	0.70	2.20	0.00	0.00	0.11	0.96	2.39
CA_22lc98	0.00	0.00	0.75	2.40	5.16	0.00	0.20	1.55	3.46	7.35
CA_25lc98	0.00	0.00	0.96	2.94	6.27	0.00	0.22	1.47	3.20	5.80
CA_26lc98	0.00	0.00	0.00	0.29	1.48	0.00	0.00	0.15	0.92	3.66
CA_27lc98	0.00	0.97	5.15	10.32	17.44	0.00	1.08	5.03	11.18	16.71
CA_28lc98	0.00	3.16	8.33	17.33	30.10	1.64	6.16	11.26	21.39	31.74

	No Apparent Change 1985-1998					Changed 1985-1998				
CA_29lc98	0.00	0.00	3.28	10.39	22.10	0.00	0.24	4.61	9.60	20.75
CA_2LC98	0.00	1.27	3.60	7.06	12.03	0.00	2.27	4.26	7.15	12.78
CA_30lc98	0.00	0.00	0.00	1.51	4.57	0.00	0.00	0.00	1.07	3.82
CA_31lc98	0.00	1.46	4.00	7.46	11.14	0.00	1.78	3.78	7.59	10.77
CA_32lc98	0.00	3.55	10.35	17.57	24.34	0.00	4.17	9.35	15.30	21.40
CA_33lc98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CA_36lc98	0.00	0.00	0.00	0.00	0.24	0.00	0.00	0.00	0.00	0.41
CA_3lc98	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.10	0.64
CA_4lc98	0.00	0.00	1.09	4.44	10.30	0.00	0.17	2.04	6.52	10.60
CA_5lc98	0.00	0.00	0.43	1.15	2.24	0.00	0.00	0.66	1.09	2.73
CA_6lc98	0.00	0.00	0.00	0.63	2.82	0.00	0.00	0.11	0.70	2.03
CA_7lc98	0.00	0.00	2.20	5.10	8.28	0.00	0.00	2.08	4.82	7.22
CA_8lc98	0.00	0.00	4.65	16.50	27.84	0.00	0.17	2.41	11.76	19.82
CA_9lc98	0.00	0.00	0.26	0.82	1.54	0.00	0.00	0.55	0.96	1.73
CA_AgRuralPct	0.00	0.00	0.00	0.01	17.41	0.00	0.00	0.00	1.79	21.42
CA_CDApct	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.61
CA_CommAgPct	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CA_ElevAvg	92.11	149.42	218.25	325.93	393.95	117.87	174.95	217.76	316.49	420.06
CA_ElevMax	136.92	211.84	298.27	411.87	475.18	177.17	229.06	324.97	463.89	507.78
CA_FedPct	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CA_fy_EvenPct	0.00	0.00	0.00	1.95	8.11	0.00	0.00	0.00	2.49	6.62
CA_fy_ROWpct	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CA_fy_SalvgPct	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CA_fy_UnevenPct	0.00	0.00	0.00	0.00	3.31	0.00	0.00	0.00	0.03	1.68
CA_gwHiPct	1.26	4.98	17.98	50.62	97.08	0.59	4.63	12.46	36.76	99.93
CA_gwLoPct	1.10	4.47	22.03	58.84	89.82	2.23	6.58	25.28	55.62	91.98
CA_gwMedPct	22.91	52.67	83.96	100.00	100.00	32.39	58.62	83.00	97.75	100.00
CA_HydDNRpct	1.64	4.73	11.96	25.51	70.28	2.05	4.40	12.90	19.20	52.99
CA_HydNRCSpct	0.79	1.86	4.89	10.67	19.30	0.69	1.68	4.61	9.28	11.62
CA_LC98dom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CA_LC98pctDom	16.34	19.81	26.17	35.71	49.81	13.41	16.87	22.86	32.35	44.25
CA_LmfgPct	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CA_madelandPct	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CA_MunicPct	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.01
CA_parkPct	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CA_precip	23.00	26.79	28.67	29.00	33.00	23.00	25.00	28.21	31.00	34.41
CA_rd0ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CA_rd10ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CA_rd11ft	0.00	0.00	0.00	800.14	2740.63	0.00	0.00	0.00	1185.52	6423.13
CA_rd13ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CA_rd14ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CA_rd1ft	0.00	0.00	5.63	1657.58	5986.42	0.00	0.00	1007.53	3776.72	14757.29
CA_rd2ft	0.00	0.00	0.00	1045.85	4543.53	0.00	0.00	0.00	1611.04	9125.48
CA_rd3ft	0.00	0.00	0.00	0.00	727.17	0.00	0.00	0.00	0.00	1504.94
CA_rddens	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CA_RevuDistPct	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CA_roadft	0.00	0.00	747.14	5006.48	13261.16	0.00	159.63	1874.09	10125.43	39281.09
CA_RurAirpPct	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CA_RuralPct	0.00	43.16	83.96	100.00	100.00	0.00	53.68	80.65	100.00	100.00
CA_RurCtrPct	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CA_RurForestPct	0.00	0.00	0.00	4.46	22.37	0.00	0.00	0.00	5.82	20.68
CA_RurResPct	0.00	0.00	0.00	0.00	11.79	0.00	0.00	0.00	0.00	26.33
CA_RurServPct	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CA_RurVillPct	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

	No Apparent Change 1985-1998					Changed 1985-1998				
CA_SlopeAvg	4.52	6.09	8.45	11.84	16.29	4.48	5.90	8.31	11.04	13.47
CA_SlopeDom	0.00	1.00	1.00	1.00	2.00	0.00	1.00	1.00	1.00	2.00
CA_SlopeMax	16.93	23.69	38.83	58.61	78.07	18.56	26.96	39.58	62.66	87.06
CA_SoilDom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CA_str1ft	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CA_str3ft	0.00	0.00	0.00	0.00	34.54	0.00	0.00	0.00	0.00	9981.03
CA_str4ft	0.00	0.00	0.00	875.71	3810.34	0.00	0.00	0.00	7142.28	13702.48
CA_str5ft	0.00	0.00	0.00	2216.16	6420.42	0.00	0.00	817.95	4747.29	12651.19
CA_str9ft	0.00	0.00	230.55	2241.12	4921.91	0.00	0.00	53.92	5214.38	12756.23
CA_strFtSum	176.92	553.54	2193.99	6283.42	11708.61	55.63	990.43	5407.85	13142.27	49613.67
CA_ZoneDomPct	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CavNestDucks	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CDAac	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chaniz	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ChlorideAvg	7.18	11.00	19.00	61.64	321.71	0.00	10.62	20.00	59.29	75.85
ChlorideMax	11.00	12.00	19.00	68.00	360.00	0.00	19.00	25.00	65.00	109.70
ClayDom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Clearg_Li	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CommAgAc	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Conduc	0.05	0.11	0.18	0.50	15.10	0.11	0.11	0.14	4.28	8.40
Crops	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CTI	8.68	10.23	12.09	14.04	15.98	8.40	10.07	11.81	14.44	15.88
Curva	-0.67	-0.33	-0.22	0.00	0.11	-0.44	-0.33	-0.11	0.08	0.22
DamNoWC	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00
DamWC	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	5.00
DepthDryFlow	0.00	0.00	0.00	2.00	3.80	1.00	1.00	1.00	1.00	1.00
DepthDryStand	0.00	0.00	12.00	42.00	74.40	0.00	0.00	12.00	36.00	36.00
DepthWetFlow	1.90	3.00	5.00	12.00	27.90	6.00	6.00	6.00	6.00	6.00
DepthWetStand	3.10	12.00	36.00	72.00	117.60	1.00	4.50	30.00	45.00	60.00
DevelHiDen	0.00	0.00	0.00	0.03	8.08	0.00	0.00	0.00	2.70	8.12
DevelLoDen	0.00	0.00	0.00	5.81	19.03	0.00	0.00	0.42	4.17	12.56
DevelLoDenGrass	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DevelLoDenSS	0.00	0.00	0.00	0.00	4.85	0.00	0.00	0.06	3.71	9.45
DFLY	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Dike	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	2.00
Diked_NWI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
DistBarn	45.50	71.25	112.50	200.00	720.00	0.00	0.00	0.00	0.00	0.00
DistComm	0.00	22.50	187.50	800.00	800.00	25.00	25.00	62.50	100.00	100.00
DistOthStruc	100.00	100.00	300.00	3000.00	3000.00	100.00	100.00	100.00	100.00	100.00
DistPermRes	40.00	100.00	200.00	262.50	500.00	0.00	65.00	125.00	300.00	500.00
DistSchool	40.00	40.00	107.50	268.75	300.00	0.00	0.00	0.00	0.00	0.00
DistSeasRes	30.00	50.00	100.00	300.00	380.00	55.00	66.25	125.00	187.50	200.00
Ditch	0.00	0.00	0.00	1.00	5.00	0.00	0.00	0.00	0.50	5.00
Ditch_Li	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ditched_NWI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DitchFt	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dom_wetnnt	0.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	1.00	1.00
Dom_wetntv	2.00	3.00	3.00	4.00	5.00	1.10	2.00	3.00	5.00	5.90
Dom_wetntvPct	0.56	0.75	0.83	1.00	1.00	0.52	0.73	1.00	1.00	1.00
Domavg_sal	1.33	1.60	2.00	2.33	4.30	1.41	1.63	1.88	2.00	2.30
Domavg_wet	5.64	6.43	7.29	8.00	9.00	5.00	5.94	7.00	8.20	8.47
Dommax_sal	2.00	2.00	3.50	4.00	6.00	2.00	2.00	2.00	3.25	4.00
Dommaxwets	8.00	10.00	10.00	10.00	10.00	5.30	8.00	10.00	10.00	10.00
Domnntv	0.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	1.00	1.00

	No Apparent Change 1985-1998					Changed 1985-1998				
DomnntvPct_	0.00	0.00	0.00	0.20	0.33	0.00	0.00	0.00	0.21	0.32
DomNox1	0.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	1.00	1.00
DomNox12	0.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	1.00	1.00
DomNox2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Domntv	2.00	3.00	3.00	4.50	5.00	1.10	2.75	3.50	5.00	5.90
Domspp	2.00	3.00	4.00	5.00	6.30	1.20	3.00	4.00	5.00	5.90
Domwet	2.00	3.00	4.00	5.00	6.00	1.20	3.00	3.00	5.00	5.90
DomwetPct	0.75	0.80	1.00	1.00	1.00	0.75	0.94	1.00	1.00	1.00
Downcut	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
Drain	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Drwy_Li	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dscore	0.00	0.00	1.00	2.00	4.00	0.00	1.00	2.00	4.00	6.40
DscoreVegIncl	0.00	0.00	1.00	5.00	7.00	1.00	2.75	5.00	8.00	8.00
DUCKS	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00
EAGLE	0.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
Elevation	20.99	88.42	161.84	263.91	345.85	32.38	89.63	174.75	262.91	372.64
Em_NWI	0.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00
Emavgwetsc	5.45	6.24	6.81	7.36	8.09	5.22	6.05	6.90	7.68	7.93
Emnntv	0.60	1.50	3.00	4.00	6.00	0.10	2.50	4.00	6.00	8.70
EmnntvPct	0.03	0.10	0.16	0.23	0.30	0.01	0.13	0.20	0.23	0.34
Emntv	4.60	6.00	10.00	12.50	17.00	6.10	7.00	10.50	18.00	18.90
EmPctIC	15.00	25.00	50.00	75.00	90.00	10.00	15.00	60.00	87.50	90.00
Emspp	9.00	13.00	18.00	22.00	28.40	15.00	16.50	17.50	27.50	37.10
Emwetspp	6.00	9.00	13.00	16.00	23.00	9.20	12.50	13.00	22.50	26.70
EstuNWI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excav	0.00	0.00	0.00	3.00	4.00	0.00	0.00	0.00	0.00	2.00
Excav_Li	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Excav_NWI	0.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	0.50	1.00
Fac_minus_	0.00	0.00	1.00	1.00	2.00	0.00	0.75	1.00	1.25	2.00
Fac_spp	1.00	3.00	4.00	6.00	7.00	3.10	4.00	4.50	5.75	8.00
Facplus_sp	1.00	2.00	2.00	3.00	4.00	1.00	1.75	2.50	3.25	4.90
Facu_minus	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.25	1.90
Facu_plus_	0.00	0.00	1.00	1.00	2.00	0.00	0.75	1.00	2.25	3.90
Facu_spp	1.00	3.00	4.00	5.50	8.00	1.10	3.50	5.00	5.25	6.00
Facw_minus	0.00	0.00	1.00	2.00	2.00	0.00	0.00	0.50	1.00	1.90
Facw_plus_	0.00	0.00	1.00	2.00	3.00	0.10	1.00	2.00	2.25	3.00
Facw_spp	1.00	2.00	3.00	4.00	6.00	2.10	3.00	4.00	6.00	6.90
FedLandAc	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fence	0.00	0.00	0.00	1.00	7.00	0.00	0.00	0.00	3.00	7.00
Fence_Li	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Field_Li	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fill_Li	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FillGrade	0.00	0.00	0.00	0.00	4.60	0.00	0.00	0.00	0.50	3.00
FishFt	0.00	0.00	0.00	0.00	145.92	0.00	0.00	0.00	0.00	417.60
FlatLiDAR	0.00	0.40	0.85	1.00	1.00	0.00	0.20	0.55	1.00	1.00
FlowAcc	83.61	334.45	2341.16	17182.42	132208.50	91.97	438.97	3219.09	28804.59	118955.80
FO_NWI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
ForestDecid	0.00	0.00	0.00	0.00	1.87	0.00	0.00	0.00	0.34	2.44
ForestEverg	0.00	0.00	0.00	0.00	1.27	0.00	0.00	0.00	0.00	1.77
ForestEvgrOpen	0.00	0.00	0.00	1.86	17.60	0.00	0.00	0.00	1.71	15.18
ForestMix	0.00	0.00	0.00	0.40	9.81	0.00	0.00	0.00	0.56	5.39
ForestOpenSS	0.00	0.00	0.00	0.00	4.41	0.00	0.00	0.00	1.71	6.76
ForestSSgrass	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11
FROG	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

	No Apparent Change 1985-1998					Changed 1985-1998				
FyOpsAc	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26
FyOpsPct	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60
GeoAltExtent	0.00	0.00	0.05	0.20	0.40	0.01	0.10	0.20	0.40	0.60
Gradg_Li	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GrassShort	0.00	0.00	4.13	20.25	38.90	0.00	4.06	12.56	25.77	51.84
GrassSparse	0.00	0.00	0.00	2.36	13.97	0.00	0.00	0.97	8.76	17.98
GrassUrban	0.00	0.00	0.00	0.84	7.44	0.00	0.00	0.29	4.44	8.97
GravelDom	0.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	1.00	1.00
Graz	0.00	0.00	0.00	4.00	9.60	0.00	0.00	0.00	7.00	10.00
GRd_Li	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
GWhiAc	0.00	0.00	0.00	0.00	1.78	0.00	0.00	0.00	0.10	3.21
GWhiPct	0.00	0.00	0.00	0.00	80.57	0.00	0.00	0.00	3.31	56.65
GWloAc	0.00	0.00	0.00	0.39	3.32	0.00	0.00	0.00	3.03	14.60
GWloPct	0.00	0.00	0.00	28.98	99.21	0.00	0.00	0.00	63.76	99.97
GWmedAc	0.00	0.13	0.76	2.91	10.31	0.00	0.19	2.54	11.52	33.67
GWmedPct	0.00	16.88	90.95	100.00	100.00	0.00	14.86	79.03	100.00	100.00
GWsamp	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HabEffect	12.30	17.25	21.00	25.00	27.70	12.50	18.50	22.00	25.25	27.80
HabWDOE	12.30	17.25	21.00	25.00	27.70	12.50	18.50	22.00	25.25	27.80
HarlequinD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HAWK	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
HERON	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
HGMclass	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hort	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00
Hyd1_2NRCS	35.07	100.00	100.00	100.00	100.00	61.44	98.83	100.00	100.00	100.00
Hyd1pctNRCS	0.00	0.00	0.00	59.95	97.28	0.00	0.00	0.00	67.03	88.54
HydEffect	5.00	7.00	8.00	12.00	12.70	2.30	5.00	8.00	10.50	12.00
HydricDNRac	0.00	0.00	0.00	0.98	5.90	0.00	0.00	0.00	4.60	31.21
HydricDNRpct	0.00	0.00	0.00	55.34	98.96	0.00	0.00	0.00	63.34	91.66
HydWDOE	5.00	8.00	10.00	12.00	14.00	2.30	7.25	9.00	12.00	19.20
HypdPermPctIC	0.00	0.00	5.00	40.00	78.00	0.00	0.00	5.00	64.50	75.00
HypdSatPctIC	0.00	10.00	59.00	85.00	94.60	15.00	30.00	60.00	94.50	96.00
HypdSeasPctIC	0.00	3.00	7.00	25.00	40.00	0.00	1.50	5.00	20.00	30.00
HypdTempPctIC	0.00	0.00	3.00	5.00	10.00	0.00	0.00	5.00	7.50	20.00
I_PERM	0.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	1.00	1.00
ICacTot	0.00	0.10	0.90	3.94	14.00	0.00	0.75	3.88	14.59	61.51
IConlyAc	0.00	0.00	0.64	2.41	8.72	0.00	0.45	2.97	10.88	37.86
IConlyPct	0.00	0.00	65.42	100.00	100.00	0.00	45.13	76.95	100.00	100.00
ICpctTot	0.00	48.64	97.32	100.00	100.00	0.00	88.46	98.25	100.00	100.00
ImpervEdgePct	0.00	0.00	0.00	10.00	35.00	0.00	0.00	1.00	15.00	35.00
IndicChanHt	2.00	2.00	4.50	12.00	27.60	1.00	1.00	2.50	4.00	4.00
IndicStandHt	3.00	5.25	13.00	24.00	40.20	2.00	2.00	12.00	12.00	24.00
Intertidal_NWI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IntExp_NWI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
InwetSum	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00
LacusNWI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LakeFtDNR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LandfSoilDom	4.00	4.00	4.00	4.00	5.00	4.00	4.00	4.00	5.00	5.00
LawnEdgePct	0.00	0.00	0.00	5.00	33.00	0.00	0.00	0.00	14.50	30.00
LawnPast	0.00	0.00	0.00	3.00	7.00	0.00	0.00	0.00	2.00	8.00
LightMfgAc	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LinearAlt	1.00	1.00	1.00	3.00	5.00	1.00	1.00	3.00	4.00	5.00
LoamDom	0.00	0.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Logged	2.00	4.00	4.00	4.00	4.00	1.00	2.00	4.00	4.00	4.00

	No Apparent Change 1985-1998					Changed 1985-1998				
LogOthr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MadeLandPct	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MatureFor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Max_salsco	4.00	4.00	4.00	6.00	6.00	4.00	4.00	4.00	6.00	6.00
MaxParcelsPerOwnr	1.00	1.00	1.00	2.00	3.00	1.00	1.00	2.00	3.00	4.80
Maxwetscor	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
MossPctIC	0.00	0.00	0.00	5.00	10.00	0.00	0.00	1.00	10.00	20.00
Mow	0.00	0.00	0.00	7.00	8.00	0.00	0.00	0.00	6.50	10.00
Mowed	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26
MuckDom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MuckPeatPctAc	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14.95
MunicAc	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MUSKRAT	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
Native_spp	11.00	13.00	18.00	25.00	31.00	13.10	14.75	24.50	30.25	33.70
NewChange	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NHPpctAllMax	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NHPpctWetMax	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NnABpc	0.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00
NnEMpc	0.00	1.00	7.00	40.00	80.00	1.00	1.50	10.00	30.00	90.00
NnSSFOpc	0.00	0.00	2.00	5.00	20.00	0.00	1.00	1.00	12.50	45.00
No_change	0.00	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
NO3Avg	0.00	0.06	0.22	0.53	2.49	0.00	0.08	0.10	1.80	6.76
NO3Max	0.00	0.25	0.60	1.30	2.49	0.00	0.20	0.25	2.30	7.70
NoDomNox	0.50	3.00	4.00	5.00	5.00	1.10	2.75	3.50	5.00	5.90
NonHydric1NRCS	0.00	0.00	0.00	31.51	68.59	0.00	0.00	0.00	32.83	70.91
NonHydric2NRCS	0.00	0.00	0.00	0.00	18.29	0.00	0.00	0.00	0.01	17.37
NonHydricDNR	0.00	0.00	0.00	30.62	71.82	0.00	0.00	0.00	36.39	76.56
Nonnative_	1.00	3.00	6.00	9.00	12.40	0.30	3.75	6.50	11.00	18.80
NonnativePct	0.05	0.11	0.22	0.32	0.42	0.01	0.12	0.23	0.40	0.54
Nonntvdom	0.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	1.00	1.00
Nonntvwets	0.60	1.50	3.00	5.00	6.00	0.10	2.50	4.00	6.00	8.70
NotNox	12.00	15.00	20.00	27.00	33.00	18.00	19.50	27.00	32.50	35.80
Nox1	0.00	1.00	3.00	5.00	6.00	0.00	0.75	3.00	6.25	9.70
Nox12	1.00	2.00	4.00	7.00	8.00	0.00	0.75	5.00	7.25	11.90
Nox2	0.00	0.00	1.00	2.00	3.00	0.00	0.00	1.50	2.00	3.80
Ntvdom	2.00	3.00	4.00	5.00	5.00	1.10	2.75	3.50	5.00	5.90
Ntvwetspp	8.00	10.00	14.00	20.00	27.00	9.20	12.50	17.00	24.00	28.80
NtvwetsppPct	0.43	0.52	0.62	0.69	0.75	0.36	0.50	0.60	0.66	0.73
Num_spp	15.00	19.50	24.00	32.00	40.40	21.20	23.75	31.00	38.25	43.80
Num_strata	2.00	3.00	3.00	4.00	4.00	3.00	3.00	3.00	4.00	4.00
NumOwners	1.00	2.00	4.00	7.00	14.50	2.00	3.00	7.00	15.00	27.00
NumParcels	1.00	2.00	4.00	8.00	18.00	2.30	4.00	8.00	18.25	31.20
NumWetDown	1.00	2.00	2.00	4.00	5.00	1.00	1.00	2.00	4.00	6.00
NumWetUp	1.00	1.00	1.00	3.00	5.20	1.00	1.00	1.00	3.25	11.00
NWIacTot	0.00	0.00	0.39	1.76	7.29	0.00	0.00	1.19	3.96	16.30
NWIdiked	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
NWIditch	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NWIdomCode	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NWIexcav	0.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	0.50	1.00
NWInumClasses	0.00	0.00	1.00	1.00	2.00	0.00	1.00	1.00	2.00	3.00
NWInumCodes	1.00	1.00	1.00	1.00	2.00	1.00	1.00	1.00	2.00	4.00
NWInumHypds	1.00	1.00	1.00	1.00	2.00	1.00	1.00	1.00	2.00	3.00
NWIonlyAc	0.00	0.00	0.12	0.63	1.92	0.00	0.00	0.18	1.17	2.93
NWIonlyPct	0.00	0.00	2.68	51.36	100.00	0.00	0.00	1.75	11.54	100.00

	No Apparent Change 1985-1998					Changed 1985-1998				
NWIowPct	0.00	0.00	0.00	35.98	100.00	0.00	0.00	0.00	3.42	28.47
NWIpctTot	0.00	0.00	34.57	100.00	100.00	0.00	0.00	23.05	54.87	100.00
Obl_spp	2.00	4.00	6.00	9.00	11.00	2.10	3.75	6.00	14.00	17.00
Oblpct	0.09	0.18	0.23	0.31	0.41	0.08	0.15	0.23	0.33	0.45
OpenWater	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OSPREY	0.00	0.50	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
Other_stat	0.00	0.00	1.00	2.00	4.00	0.10	1.00	1.50	2.50	4.00
OWL	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
OwnerNO	0.00	0.00	0.00	1.00	2.00	0.00	0.00	1.00	2.00	3.00
OwnerNoREP	0.00	1.00	2.00	4.00	9.00	1.00	2.00	4.00	8.50	20.00
OwnerYES	0.00	0.00	1.00	1.00	3.00	0.00	0.00	1.00	2.00	3.00
OWshallow	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40
PalusNWI	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ParcelNO	0.00	0.00	0.00	1.00	2.60	0.00	0.00	1.00	2.00	3.00
ParcelNoRep	0.00	1.00	2.00	4.00	11.60	1.00	2.00	5.00	11.50	25.00
ParcelsPerOwner	1.00	1.00	1.00	1.32	2.00	1.00	1.00	1.05	1.36	1.68
ParcelYES	0.00	0.00	1.00	2.00	4.00	0.00	0.00	1.00	3.00	6.80
ParkAc	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PastureEdgePct	0.00	0.00	10.00	50.00	85.00	0.00	0.00	5.00	35.00	88.00
PctNatur	0.00	0.10	0.97	1.00	1.00	0.00	0.00	0.20	0.75	1.00
PeatDom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PeatPctAc	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.98
PermF_NWI	0.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	1.00	1.00
PermF2_NWI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pit_Li	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PIWO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PkgLot_Li	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PlantOth	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pond_	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pond_Li	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PondPct	0.00	0.00	0.00	0.05	0.50	0.00	0.00	0.00	0.05	0.15
PRd_Li	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Precip	23.00	27.00	29.00	29.00	33.00	23.00	25.00	28.00	31.00	35.00
Rd_Li	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RdFt0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RdFt1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	556.35
RdFt11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	224.52
RdFt14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RdFt2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RdFt3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RdFtSum	0.00	0.00	0.00	0.00	94.87	0.00	0.00	0.00	192.69	875.08
Refor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00
RevuDistAc	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Riparian	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RiparVeg	0.00	0.00	0.00	0.00	2.36	0.00	0.00	0.00	0.00	1.75
Riprap	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00
Road	0.00	0.00	0.00	5.00	7.00	0.00	0.00	0.00	6.00	7.00
ROWcut	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RuralAc	0.00	0.00	0.55	2.48	8.38	0.00	0.17	2.48	11.35	45.59
RuralAgAc	0.00	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.00	1.56
RuralCtrAc	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RuralForestAc	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16
RuralLawn	0.00	0.00	0.00	7.47	23.17	0.00	0.00	5.21	11.31	21.62
RuralResAc	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.38

	No Apparent Change 1985-1998					Changed 1985-1998				
RuralServAc	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RuralVillAc	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SALA	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SALMO	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
SandCoarseDom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SandDom	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	1.00
SandFineDom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Satur_NWI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SBIRD	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
ScoreEffect	24.00	31.25	38.00	46.00	50.40	28.00	31.00	36.50	45.75	51.60
ScoreWDOE	28.00	35.25	44.00	53.00	63.00	36.00	36.75	46.50	53.25	58.80
SeabirdConc	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SEAS	0.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00
SeasF_NWI	0.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00
SeasF2_NWI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SeasF3_NWI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SeasTidal_NWI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SedBarr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SedDepos	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SemiF_NWI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
SemipTidal_NWI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ShadedOW	0.00	5.00	30.00	80.00	100.00	5.00	5.00	70.00	98.75	100.00
ShedAgPct	3.72	8.47	19.33	23.77	44.27	3.72	8.43	15.89	23.69	31.00
ShedDevPct	10.37	12.81	19.63	28.39	38.68	9.84	11.99	19.63	29.50	59.88
ShedFyPct	1.82	2.37	3.55	5.13	8.27	1.82	2.37	3.71	5.62	10.42
ShedPockEstu	0.00	0.00	1.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00
ShedRdDens	28.43	31.52	35.32	46.79	57.43	29.84	32.11	35.39	46.92	60.91
ShedRisk	0.13	0.25	0.48	0.66	0.94	0.17	0.25	0.50	0.78	0.93
ShedSalmo	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	1.00
ShorebConc	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Shrub_wets	0.00	1.00	4.00	6.00	8.00	1.10	3.50	4.50	6.25	7.90
ShrubAgMix	0.00	0.00	0.00	6.82	29.76	0.00	0.00	0.10	5.14	13.87
Shrubavg_w	3.49	4.20	5.00	5.79	6.71	3.30	4.22	5.30	7.20	7.41
ShrubDecid	0.00	0.00	0.34	14.89	32.82	0.00	0.00	1.34	6.91	15.04
ShrubEvgr	0.00	0.00	0.00	4.32	14.06	0.00	0.00	0.99	5.82	13.32
ShrubForest	0.00	0.00	0.00	9.80	24.30	0.00	0.00	0.62	7.03	21.28
ShrubGrass	0.00	0.00	0.00	8.23	22.49	0.00	0.00	1.93	10.86	18.67
Shrubnntv	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ShrubnntvPct	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Shrubntv	0.00	1.00	4.00	6.00	7.00	1.10	3.50	4.50	6.25	7.90
Shrubspp	1.00	2.00	6.00	9.00	12.00	4.00	4.75	5.00	8.75	14.00
ShrubUrban	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.32
SideChanFtDNR	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SiltDom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.70
SlopeDEM	0.48	1.07	2.16	4.10	7.03	0.34	1.03	2.05	3.42	6.03
SlopeSoilDom	0.00	0.00	1.00	1.00	2.00	0.00	0.00	1.00	1.00	1.00
SoilDomPct	50.74	63.86	93.53	100.00	100.00	41.23	58.46	80.66	100.00	100.00
SoilDomTyp	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Spray	0.00	0.00	0.00	0.00	1.60	0.00	0.00	0.00	0.00	0.00
SS_NWI	0.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	1.00	1.00
Stormw	0.00	0.00	0.00	0.00	3.80	0.00	0.00	0.00	0.00	5.00
Stream1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Stream2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Stream3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

	No Apparent Change 1985-1998					Changed 1985-1998				
Stream4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	218.18
Stream5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	51.31
StreamFt	0.00	0.00	0.00	0.00	439.13	0.00	0.00	0.00	0.00	1793.19
Subtidal_NWI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Supratidal_NWI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SWsamp	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TempF_NWI	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	1.00
TempTidal_NWI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tide_annualPct	0.00	0.00	0.00	35.00	96.00	0.00	0.00	1.00	2.00	2.00
Tide_dayPact	0.00	0.00	1.00	10.00	42.00	0.00	0.00	0.00	0.00	0.00
Tide_ponded	0.00	0.00	0.00	3.75	51.00	0.00	0.00	0.00	0.00	0.00
Tillage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.00
TOAD	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
Trail	0.00	0.00	0.00	0.00	7.00	0.00	0.00	0.00	0.00	7.00
Trail_Li	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TrashP	0.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00	5.00	7.00
Tree_wetsp	0.00	1.00	2.00	3.00	4.00	1.00	1.75	2.00	3.00	3.90
Treenntv	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TreenntvPct_	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Treentv	0.00	1.00	2.00	3.00	4.00	1.00	1.75	2.00	3.00	3.90
Treespp	0.00	1.00	2.00	3.00	4.40	1.00	1.75	2.50	3.25	5.80
TreeSSpctIC	1.00	10.00	35.00	80.00	93.00	5.00	17.50	65.00	87.50	90.00
TURTLE	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
UB_NWI	0.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	1.00	1.00
UrbanNatOpenSp	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
US_NWI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VegAlt	0.00	0.00	0.12	0.70	1.00	0.10	0.25	0.75	1.00	1.00
VehTrax	0.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00	0.00	5.00
WatColor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WaterEdgePct	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WatPermPctIC	0.00	0.00	5.00	40.00	73.80	0.00	0.00	1.00	65.00	75.00
WatrRemov	0.00	0.00	0.00	0.00	3.40	0.00	0.00	0.00	0.00	0.00
WDOEcat	2.00	2.00	3.00	3.00	4.00	2.00	2.00	3.00	3.00	3.00
WetEmEst	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WetEmForest	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.63
WetEmNonEst	0.00	0.00	0.00	0.00	4.87	0.00	0.00	0.00	2.26	6.12
WetEmSS	0.00	0.00	0.00	2.50	9.76	0.00	0.00	0.22	4.29	7.91
WetForest	0.00	0.00	0.00	0.00	1.24	0.00	0.00	0.00	0.40	3.10
WetPctCA	0.55	2.16	7.33	19.23	39.03	1.15	4.45	11.41	28.36	49.81
WetPctShed	0.01	0.02	0.06	0.30	1.01	0.01	0.06	0.22	1.03	3.03
WetShrub	0.00	0.00	0.00	1.01	6.99	0.00	0.00	0.00	3.10	7.81
WetSystem	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WfowlConc	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WoodDuck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WoodyEdgePct	3.20	20.00	60.00	90.00	99.20	10.00	27.50	90.00	90.00	100.00
WQ_WDOE	4.30	8.00	12.00	17.50	24.00	3.50	12.50	14.00	19.00	27.40
WQeffect	3.00	5.00	7.00	10.00	13.70	3.40	7.00	8.00	11.75	14.00

Table D7.4. Wetlands That Were Altered Between 1985 and 1998: Characteristics of Surroundings

For explanation of the abbreviated names in the first column, see Appendix B. As an example of how to interpret data in this table, consider the characteristic, "CDA100" and look in the two columns labeled "50th" (percentile). The 77.38 in column 4 indicates that, considering Critical Drainage Area (CDA) designation within just the 50-100 ft zone (CDA100) around an Island County wetland, half the wetlands that showed no apparent change had at least 77.38% of that zone designated as a CDA, whereas half had less (i.e., 77.38 = median). In comparison, as shown in the 3rd column from right end, half the wetlands that did show change had 100% of that zone designated as a CDA, and half had less (i.e., 100 = median). The 20.17 in the first of the two "25th" percentile columns indicates that, of the wetlands that did not change, less than one-quarter had less than 20.17% of their 50-100 ft zone as a CDA, whereas in the second of the "25th" percentile columns, the 76.16 indicates that less than one quarter of the wetlands that did change had less than 76.16% of that zone as a CDA. If all corresponding percentiles are identical between the "Changed" and "No Apparent Change" conditions, it likely indicates that the particular characteristic was not associated (at least not directly) with the changes.

	No Apparent Change 1985-1998					Changed 1985-1998				
	10th	25th	50th	75th	90th	10th	25th	50th	75th	90th
AgComm100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AgComm150	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AgComm300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AgComm50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AgRural100	0.00	0.00	0.00	0.00	23.70	0.00	0.00	0.00	0.00	30.71
AgRural150	0.00	0.00	0.00	0.00	24.96	0.00	0.00	0.00	0.00	28.88
AgRural300	0.00	0.00	0.00	0.00	25.79	0.00	0.00	0.00	0.00	27.38
AgRural50	0.00	0.00	0.00	0.00	21.11	0.00	0.00	0.00	0.00	27.88
Airpt100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Airpt150	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Airpt300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Airpt50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bare100	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.91
Bare150	0.00	0.00	0.00	0.00	0.38	0.00	0.00	0.00	0.00	1.35
Bare300	0.00	0.00	0.00	0.00	1.44	0.00	0.00	0.00	0.01	1.77
Bare50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.87
CDA100	0.00	20.17	77.38	100.00	100.00	7.97	76.16	100.00	100.00	100.00
CDA150	0.00	23.63	70.29	100.00	100.00	9.37	75.57	100.00	100.00	100.00
CDA300	7.44	26.23	57.87	100.00	100.00	9.41	68.58	100.00	100.00	100.00
CDA50	0.00	12.48	93.63	100.00	100.00	6.47	75.47	100.00	100.00	100.00
DevelHiDens100	0.00	0.00	0.00	1.55	9.96	0.00	0.00	0.00	3.63	10.47
DevelHiDens150	0.00	0.00	0.00	2.02	9.39	0.00	0.00	0.23	4.14	9.78
DevelHiDens300	0.00	0.00	0.00	2.83	7.57	0.00	0.00	1.78	4.68	13.26
DevelHiDens50	0.00	0.00	0.00	0.97	9.04	0.00	0.00	0.00	3.29	11.58
DevelLoDens100	0.00	0.00	2.25	8.22	15.39	0.00	0.00	2.68	7.57	12.69
DevelLoDens150	0.00	0.00	2.56	8.19	14.03	0.00	0.09	4.71	9.09	13.38
DevelLoDens300	0.00	0.35	3.39	7.63	12.70	0.00	2.37	5.49	10.32	14.42
DevelLoDens50	0.00	0.00	0.36	8.08	18.57	0.00	0.00	1.20	6.06	15.21
DevelLoDenSS100	0.00	0.00	0.00	2.61	9.44	0.00	0.00	1.32	6.38	14.19
DevelLoDenSS150	0.00	0.00	0.00	3.28	9.17	0.00	0.00	2.04	6.20	14.28
DevelLoDenSS300	0.00	0.00	0.39	4.02	7.88	0.00	0.00	2.31	5.54	12.68
DevelLoDenSS50	0.00	0.00	0.00	1.17	9.06	0.00	0.00	0.35	5.10	14.57
FedLand100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FedLand150	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FedLand300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FedLand50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ForestDecid100	0.00	0.00	0.00	0.00	4.64	0.00	0.00	0.00	1.58	4.02
ForestDecid150	0.00	0.00	0.00	0.37	4.32	0.00	0.00	0.00	1.29	4.89
ForestDecid300	0.00	0.00	0.00	1.54	3.57	0.00	0.00	0.08	1.83	3.22

	No Apparent Change 1985-1998					Changed 1985-1998				
	10th	25th	50th	75th	90th	10th	25th	50th	75th	90th
ForestDecid50	0.00	0.00	0.00	0.00	3.48	0.00	0.00	0.00	1.31	3.50
ForestEvgr100	0.00	0.00	0.00	0.00	1.71	0.00	0.00	0.00	0.00	2.08
ForestEvgr150	0.00	0.00	0.00	0.00	2.05	0.00	0.00	0.00	0.00	1.81
ForestEvgr300	0.00	0.00	0.00	0.00	2.39	0.00	0.00	0.00	0.16	1.41
ForestEvgr50	0.00	0.00	0.00	0.00	1.05	0.00	0.00	0.00	0.00	1.26
ForestEvgrOpen100	0.00	0.00	0.00	6.52	19.33	0.00	0.00	0.00	3.50	13.42
ForestEvgrOpen150	0.00	0.00	0.00	6.75	17.50	0.00	0.00	0.00	4.56	13.42
ForestEvgrOpen300	0.00	0.00	1.29	7.25	18.50	0.00	0.00	2.17	7.06	15.23
ForestEvgrOpen50	0.00	0.00	0.00	5.67	18.36	0.00	0.00	0.00	4.57	12.40
ForestMix100	0.00	0.00	0.00	3.51	9.67	0.00	0.00	0.00	3.34	8.56
ForestMix150	0.00	0.00	0.00	4.12	9.83	0.00	0.00	0.00	3.27	9.20
ForestMix300	0.00	0.00	1.41	5.17	9.80	0.00	0.00	0.57	3.22	7.67
ForestMix50	0.00	0.00	0.00	2.53	10.80	0.00	0.00	0.00	2.41	6.68
ForestOpenSS100	0.00	0.00	0.00	0.00	4.44	0.00	0.00	0.00	0.47	5.81
ForestOpenSS150	0.00	0.00	0.00	0.00	4.12	0.00	0.00	0.00	1.56	5.23
ForestOpenSS300	0.00	0.00	0.00	0.70	3.37	0.00	0.00	0.00	0.91	4.04
ForestOpenSS50	0.00	0.00	0.00	0.00	5.24	0.00	0.00	0.00	0.74	5.18
FyPct100	0.00	0.00	0.14	13.99	37.00	0.00	0.00	3.01	18.10	28.88
FyPct150	0.00	0.00	4.44	16.63	36.66	0.00	0.04	4.40	16.70	31.02
FyPct300	0.89	3.56	9.34	18.34	35.26	0.81	2.76	7.29	19.11	33.59
FyPct50	0.00	0.00	0.00	9.30	39.40	0.00	0.00	0.47	17.22	25.85
GrassShort100	0.00	0.08	9.66	21.37	35.60	0.10	6.44	13.49	24.42	34.41
GrassShort150	0.00	1.82	10.31	21.92	36.62	0.39	6.37	13.44	24.56	32.96
GrassShort300	0.33	3.64	10.16	19.95	32.26	1.01	5.45	13.15	21.57	31.98
GrassShort50	0.00	0.00	7.81	21.61	37.49	0.00	3.52	13.52	27.49	43.79
GrassSparse100	0.00	0.00	0.00	7.16	16.62	0.00	0.00	2.64	7.84	17.02
GrassSparse150	0.00	0.00	0.00	7.44	16.70	0.00	0.00	2.31	7.91	15.72
LiteMfg100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LiteMfg150	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LiteMfg300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LiteMfg50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Municip100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Municip150	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.71
Municip300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.34
Municip50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OpenWater100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OpenWater150	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OpenWater300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OpenWater50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OWshallow100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OWshallow150	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OWshallow300	0.00	0.00	0.00	0.00	0.32	0.00	0.00	0.00	0.00	0.00
OWshallow50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Park100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Park150	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Park300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Park50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RdFt100	0.00	0.00	117.66	266.53	522.11	0.00	103.60	176.22	498.88	1069.81
RdFt150	0.00	42.96	135.71	239.29	450.55	0.00	105.56	209.88	430.07	931.18
RdFt300	203.33	335.53	516.93	781.77	1259.92	303.83	397.92	700.25	1461.76	2836.49
RdFt50	0.00	0.00	0.00	183.24	409.69	0.00	0.00	118.75	287.56	699.43
RevuDist100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RevuDist150	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RevuDist300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

	No Apparent Change 1985-1998					Changed 1985-1998				
	10th	25th	50th	75th	90th	10th	25th	50th	75th	90th
RevuDist50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rural100	0.00	9.76	89.41	100.00	100.00	0.00	25.59	81.68	100.00	100.00
Rural150	0.00	16.97	80.59	100.00	100.00	0.00	24.16	82.21	100.00	100.00
Rural300	0.00	24.66	75.36	100.00	100.00	0.00	31.95	77.90	100.00	100.00
Rural50	0.00	2.34	99.93	100.00	100.00	0.00	25.13	82.22	100.00	100.00
RuralCtr100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RuralCtr150	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RuralCtr300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RuralCtr50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RuralForest100	0.00	0.00	0.00	0.00	8.64	0.00	0.00	0.00	0.00	21.43
RuralForest150	0.00	0.00	0.00	0.00	13.91	0.00	0.00	0.00	0.00	22.36
RuralForest300	0.00	0.00	0.00	0.00	18.58	0.00	0.00	0.00	0.00	22.65
RuralForest50	0.00	0.00	0.00	0.00	1.84	0.00	0.00	0.00	0.00	19.14
RuralRes100	0.00	0.00	0.00	0.00	32.36	0.00	0.00	0.00	0.00	20.72
RuralRes150	0.00	0.00	0.00	0.00	33.77	0.00	0.00	0.00	0.00	22.37
RuralRes300	0.00	0.00	0.00	0.00	36.55	0.00	0.00	0.00	0.00	19.06
RuralRes50	0.00	0.00	0.00	0.00	27.95	0.00	0.00	0.00	0.00	18.91
RuralServ100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RuralServ150	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RuralServ300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RuralServ50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RuralVill100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RuralVill150	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RuralVill300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RuralVill50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ShrubDecid100	0.00	0.00	5.45	17.25	28.89	0.00	0.00	5.24	10.95	20.26
ShrubDecid150	0.00	0.00	6.50	17.20	28.25	0.00	0.00	5.15	10.88	21.45
ShrubDecid300	0.00	1.02	7.75	16.40	24.42	0.00	1.18	5.01	11.59	20.35
ShrubDecid50	0.00	0.00	3.70	17.33	29.87	0.00	0.00	4.20	11.54	20.40

Table D7.5. Surroundings That Were Altered Between 1985 and 1998: Their Characteristics

For explanation of the abbreviated names in the first column, see Appendix B. As an example of how to interpret data in this table, consider the first characteristic, "AcresWetland" and look in the two columns labeled "50th" (percentile). The 2.18 in column 4 indicates that the median size of an Island County wetland whose surroundings changed was 2.18 acres, whereas the median size of one that did not change was only 1.24 acres as shown in the 3rd column from right end. The 0.26 in the first of the two "10th" percentile columns indicates that fewer than 10% of the wetlands whose surroundings changed were smaller than 0.26 acres. The 23.46 in the first ot the "90th" percentile columns indicates that fewer than 10% of the wetlands whose surroundings changed were larger than 23.46 acres. If all corresponding percentiles are identical between the "Changed" and "No Apparent Change" conditions, it likely indicates that the particular characteristic was not associated (at least not directly) with changes.

	Changed 1985-1998					No Apparent Change 1985-1998				
Characteristic Name	**10th**	**25th**	**50th**	**75th**	**90th**	**10th**	**25th**	**50th**	**75th**	**90th**
AcresWetland	0.26	0.64	2.18	8.28	23.46	0.23	0.48	1.24	4.17	14.61
AgComm100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AgComm150	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AgComm300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AgComm50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AgRural100	0.00	0.00	0.00	0.00	9.11	0.00	0.00	0.00	0.00	38.24
AgRural150	0.00	0.00	0.00	0.00	13.73	0.00	0.00	0.00	0.00	38.87
AgRural300	0.00	0.00	0.00	0.00	17.56	0.00	0.00	0.00	0.00	37.79
AgRural50	0.00	0.00	0.00	0.00	6.61	0.00	0.00	0.00	0.00	35.71
Airpt100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Airpt150	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Airpt300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Airpt50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bare100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11
Bare150	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.58
Bare300	0.00	0.00	0.00	0.00	1.14	0.00	0.00	0.00	0.00	1.94
Bare50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CDA100	0.00	11.10	54.04	100.00	100.00	2.44	28.06	100.00	100.00	100.00
CDA150	0.00	16.18	53.24	100.00	100.00	6.40	26.69	96.32	100.00	100.00
CDA300	6.14	18.98	52.32	100.00	100.00	17.25	32.40	80.56	100.00	100.00
CDA50	0.00	10.33	55.25	100.00	100.00	0.00	24.38	100.00	100.00	100.00
DevelHiDens100	0.00	0.00	0.00	2.11	8.69	0.00	0.00	0.00	1.55	12.10
DevelHiDens150	0.00	0.00	0.00	2.06	7.66	0.00	0.00	0.00	2.43	10.67
DevelHiDens300	0.00	0.00	0.00	2.86	7.10	0.00	0.00	0.00	3.09	8.96
DevelHiDens50	0.00	0.00	0.00	1.41	8.43	0.00	0.00	0.00	1.27	10.60
DevelLoDenGrass100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DevelLoDenGrass150	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DevelLoDenGrass300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
DevelLoDenGrass50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
DevelLoDens100	0.00	0.00	3.53	8.67	15.78	0.00	0.00	1.23	7.49	14.28
DevelLoDens150	0.00	0.00	4.11	8.91	13.67	0.00	0.00	1.76	7.39	14.10
DevelLoDens300	0.00	1.70	4.61	9.24	14.14	0.00	0.02	2.90	7.03	11.22
DevelLoDens50	0.00	0.00	1.84	8.00	18.42	0.00	0.00	0.00	7.74	18.12
DevelLoDenSS100	0.00	0.00	0.00	3.84	9.63	0.00	0.00	0.00	2.68	10.64
DevelLoDenSS150	0.00	0.00	0.00	4.60	10.13	0.00	0.00	0.00	3.20	9.04
DevelLoDenSS300	0.00	0.00	1.15	4.47	9.32	0.00	0.00	0.32	4.14	7.77
DevelLoDenSS50	0.00	0.00	0.00	2.28	8.57	0.00	0.00	0.00	1.67	11.01
FedLand100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FedLand150	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FedLand300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FedLand50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ForestDecid100	0.00	0.00	0.00	0.86	4.30	0.00	0.00	0.00	0.00	4.63

ForestDecid150	0.00	0.00	0.00	1.21	4.65	0.00	0.00	0.00	0.09	4.27
ForestDecid300	0.00	0.00	0.00	1.93	3.50	0.00	0.00	0.00	1.31	3.57
ForestDecid50	0.00	0.00	0.00	0.14	3.36	0.00	0.00	0.00	0.00	3.61
ForestEvgr100	0.00	0.00	0.00	0.00	2.68	0.00	0.00	0.00	0.00	1.08
ForestEvgr150	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	1.87
ForestEvgr300	0.00	0.00	0.00	0.10	2.41	0.00	0.00	0.00	0.00	2.24
ForestEvgr50	0.00	0.00	0.00	0.00	1.26	0.00	0.00	0.00	0.00	0.97
ForestEvgrOpen100	0.00	0.00	0.00	6.10	17.00	0.00	0.00	0.00	6.75	20.50
ForestEvgrOpen150	0.00	0.00	0.16	6.25	16.28	0.00	0.00	0.00	6.93	17.36
ForestEvgrOpen300	0.00	0.00	2.16	7.04	15.92	0.00	0.00	0.38	7.59	19.25
ForestEvgrOpen50	0.00	0.00	0.00	5.47	14.83	0.00	0.00	0.00	5.47	20.62
ForestMix100	0.00	0.00	0.00	3.95	9.48	0.00	0.00	0.00	2.86	9.67
ForestMix150	0.00	0.00	0.00	4.66	9.45	0.00	0.00	0.00	3.47	10.04
ForestMix300	0.00	0.00	1.44	4.90	9.53	0.00	0.00	1.00	4.93	9.86
ForestMix50	0.00	0.00	0.00	3.58	10.38	0.00	0.00	0.00	1.39	9.93
ForestOpenSS100	0.00	0.00	0.00	0.00	4.14	0.00	0.00	0.00	0.00	5.15
ForestOpenSS150	0.00	0.00	0.00	0.00	3.95	0.00	0.00	0.00	0.00	4.34
ForestOpenSS300	0.00	0.00	0.00	0.75	3.05	0.00	0.00	0.00	0.68	3.58
ForestOpenSS50	0.00	0.00	0.00	0.00	3.48	0.00	0.00	0.00	0.00	5.44
ForestSSgrass100	0.00	0.00	0.00	0.00	1.93	0.00	0.00	0.00	0.00	1.48
ForestSSgrass150	0.00	0.00	0.00	0.00	2.67	0.00	0.00	0.00	0.00	3.03
ForestSSgrass300	0.00	0.00	0.00	0.16	3.37	0.00	0.00	0.00	0.19	3.68
ForestSSgrass50	0.00	0.00	0.00	0.00	1.47	0.00	0.00	0.00	0.00	0.00
FyPct100	0.00	0.00	1.51	14.19	30.62	0.00	0.00	0.00	15.81	40.04
FyPct150	0.00	0.00	5.30	17.40	34.04	0.00	0.00	2.57	16.52	36.86
FyPct300	1.04	3.83	8.53	18.86	33.33	0.61	2.60	8.46	18.35	35.63
FyPct50	0.00	0.00	0.00	9.03	31.54	0.00	0.00	0.00	10.63	42.29
GrassShort100	0.00	0.82	9.46	20.13	32.82	0.00	0.33	10.99	23.47	41.64
GrassShort150	0.00	2.45	9.79	19.21	31.84	0.00	2.47	11.09	23.53	40.04
GrassShort300	0.75	3.78	9.98	18.42	29.50	0.05	3.89	11.12	21.72	35.36
GrassShort50	0.00	0.00	7.77	20.14	35.33	0.00	0.00	9.00	23.75	40.26
GrassSparse100	0.00	0.00	0.00	6.18	13.60	0.00	0.00	0.00	8.51	18.79
GrassSparse150	0.00	0.00	0.00	6.09	12.15	0.00	0.00	0.02	8.42	19.13
GrassSparse300	0.00	0.00	1.51	6.38	11.62	0.00	0.00	2.46	8.21	17.20
GrassSparse50	0.00	0.00	0.00	5.08	14.97	0.00	0.00	0.00	7.87	17.02
GrassUrban100	0.00	0.00	0.00	4.20	10.24	0.00	0.00	0.00	4.08	10.54
GrassUrban150	0.00	0.00	0.00	4.75	8.98	0.00	0.00	0.00	4.34	9.65
GrassUrban300	0.00	0.00	0.87	3.78	7.29	0.00	0.00	1.25	4.48	8.64
GrassUrban50	0.00	0.00	0.00	3.07	9.32	0.00	0.00	0.00	3.01	11.57
LiteMfg100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LiteMfg150	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LiteMfg300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LiteMfg50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mowed100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mowed150	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00
Mowed300	0.00	0.00	0.00	0.00	1.02	0.00	0.00	0.00	0.00	0.33
Mowed50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Municip100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Municip150	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Municip300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Municip50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OpenWater100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OpenWater150	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OpenWater300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.73
OpenWater50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OWshallow100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

OWshallow150	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
OWshallow300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.07
OWshallow50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Park100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Park150	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Park300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Park50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RdFt100	0.00	0.00	129.03	300.60	684.49	0.00	0.00	121.45	263.87	489.63
RdFt150	0.00	63.14	154.48	300.19	582.84	0.00	50.00	133.69	228.95	437.47
RdFt300	203.33	350.87	587.63	973.20	1736.94	207.66	333.81	491.43	746.12	1074.36
RdFt50	0.00	0.00	54.08	216.40	466.95	0.00	0.00	0.00	184.23	405.84
RevuDist100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RevuDist150	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RevuDist300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RevuDist50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RiparVeg100	0.00	0.00	0.00	0.00	1.75	0.00	0.00	0.00	0.00	2.01
RiparVeg150	0.00	0.00	0.00	0.00	1.82	0.00	0.00	0.00	0.00	1.57
RiparVeg300	0.00	0.00	0.00	0.07	1.79	0.00	0.00	0.00	0.00	2.01
RiparVeg50	0.00	0.00	0.00	0.00	1.70	0.00	0.00	0.00	0.00	2.78
Rural100	0.00	37.73	97.10	100.00	100.00	0.00	0.00	82.15	100.00	100.00
Rural150	0.00	38.89	90.70	100.00	100.00	0.00	5.16	72.89	100.00	100.00
Rural300	0.00	42.55	82.52	100.00	100.00	0.00	15.19	65.33	100.00	100.00
Rural50	0.00	36.07	100.00	100.00	100.00	0.00	0.00	96.36	100.00	100.00
RuralCtr100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RuralCtr150	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RuralCtr300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RuralCtr50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RuralForest100	0.00	0.00	0.00	0.00	14.63	0.00	0.00	0.00	0.00	3.85
RuralForest150	0.00	0.00	0.00	0.00	18.32	0.00	0.00	0.00	0.00	12.16
RuralForest300	0.00	0.00	0.00	0.00	21.41	0.00	0.00	0.00	0.00	15.75
RuralForest50	0.00	0.00	0.00	0.00	10.40	0.00	0.00	0.00	0.00	0.00
RuralLawn100	0.00	0.00	4.92	11.14	18.81	0.00	0.00	2.43	10.62	18.70
RuralLawn150	0.00	0.26	5.81	10.78	17.33	0.00	0.00	3.89	10.27	18.64
RuralLawn300	0.10	2.53	5.70	10.45	15.30	0.00	1.55	4.96	10.13	15.96
RuralLawn50	0.00	0.00	4.10	11.37	19.31	0.00	0.00	0.22	10.13	20.45
RuralRes100	0.00	0.00	0.00	0.00	40.98	0.00	0.00	0.00	0.00	23.81
RuralRes150	0.00	0.00	0.00	0.00	43.98	0.00	0.00	0.00	0.00	30.21
RuralRes300	0.00	0.00	0.00	0.00	43.24	0.00	0.00	0.00	0.00	32.62
RuralRes50	0.00	0.00	0.00	0.00	36.54	0.00	0.00	0.00	0.00	16.56
RuralServ100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RuralServ150	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RuralServ300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RuralServ50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RuralVill100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RuralVill150	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RuralVill300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RuralVill50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ShrubAgMix100	0.00	0.00	0.69	12.59	26.94	0.00	0.00	0.00	12.09	27.12
ShrubAgMix150	0.00	0.00	2.58	13.27	25.93	0.00	0.00	0.01	12.88	27.10
ShrubAgMix300	0.00	0.00	4.48	12.86	24.63	0.00	0.00	2.41	11.38	25.09
ShrubAgMix50	0.00	0.00	0.03	10.95	26.40	0.00	0.00	0.00	11.23	25.51
ShrubDecid100	0.00	0.07	7.67	17.89	29.71	0.00	0.00	2.74	15.06	26.87
ShrubDecid150	0.00	0.30	7.91	18.20	30.03	0.00	0.00	4.99	15.30	25.76
ShrubDecid300	0.00	2.51	8.09	17.21	25.12	0.00	0.20	6.95	14.98	22.91
ShrubDecid50	0.00	0.00	7.23	18.46	29.39	0.00	0.00	1.21	15.60	27.39
ShrubEvgr100	0.00	0.00	2.58	7.91	13.47	0.00	0.00	0.30	6.92	13.65

ShrubEvgr150	0.00	0.00	3.01	7.88	13.35	0.00	0.00	1.75	7.33	12.53
ShrubEvgr300	0.00	0.95	3.92	7.40	11.67	0.00	0.00	2.40	7.27	12.59
ShrubEvgr50	0.00	0.00	1.32	7.53	13.68	0.00	0.00	0.00	5.51	14.27
ShrubForest100	0.00	0.00	4.19	12.28	20.98	0.00	0.00	1.01	9.66	21.50
ShrubForest150	0.00	0.00	4.64	11.57	19.04	0.00	0.00	1.74	10.36	19.54
ShrubForest300	0.00	1.14	5.37	11.57	17.86	0.00	0.00	3.45	9.55	16.64
ShrubForest50	0.00	0.00	3.29	13.00	23.38	0.00	0.00	0.00	9.67	22.68
ShrubGrass100	0.00	0.00	1.88	7.11	14.02	0.00	0.00	0.38	8.89	18.30
ShrubGrass150	0.00	0.00	2.34	7.30	13.79	0.00	0.00	1.55	8.32	15.76
ShrubGrass300	0.00	0.00	2.56	6.22	12.61	0.00	0.00	2.37	7.10	12.31
ShrubGrass50	0.00	0.00	0.49	8.01	18.66	0.00	0.00	0.00	8.83	22.01
ShrubUrban100	0.00	0.00	0.00	0.00	2.79	0.00	0.00	0.00	0.00	2.17
ShrubUrban150	0.00	0.00	0.00	0.00	2.86	0.00	0.00	0.00	0.00	2.86
ShrubUrban300	0.00	0.00	0.00	0.38	3.76	0.00	0.00	0.00	0.43	3.73
ShrubUrban50	0.00	0.00	0.00	0.00	1.02	0.00	0.00	0.00	0.00	1.09
WetEmEst100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WetEmEst150	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WetEmEst300	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.43
WetEmEst50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WetEmForest100	0.00	0.00	0.00	0.00	1.14	0.00	0.00	0.00	0.00	1.33
WetEmForest150	0.00	0.00	0.00	0.00	1.45	0.00	0.00	0.00	0.00	1.06
WetEmForest300	0.00	0.00	0.00	0.01	1.66	0.00	0.00	0.00	0.00	1.99
WetEmForest50	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0.00	0.00	0.51
WetEmNonEst100	0.00	0.00	0.00	1.32	5.08	0.00	0.00	0.00	1.29	6.14
WetEmNonEst150	0.00	0.00	0.00	1.80	5.56	0.00	0.00	0.00	1.89	5.30
WetEmNonEst300	0.00	0.00	0.51	2.34	3.90	0.00	0.00	0.00	1.89	3.84
WetEmNonEst50	0.00	0.00	0.00	0.78	4.49	0.00	0.00	0.00	0.40	5.75
WetEmSS100	0.00	0.00	1.29	5.91	9.94	0.00	0.00	0.00	4.30	9.11
WetEmSS150	0.00	0.00	1.70	5.97	9.46	0.00	0.00	0.00	4.42	8.67
WetEmSS300	0.00	0.30	2.56	4.76	7.87	0.00	0.00	1.81	4.28	6.80
WetEmSS50	0.00	0.00	0.22	5.54	12.14	0.00	0.00	0.00	3.18	10.31
WetForest100	0.00	0.00	0.00	0.30	3.24	0.00	0.00	0.00	0.00	0.45
WetForest150	0.00	0.00	0.00	0.26	2.72	0.00	0.00	0.00	0.00	0.73
WetForest300	0.00	0.00	0.00	1.15	3.05	0.00	0.00	0.00	0.34	2.49
WetForest50	0.00	0.00	0.00	0.00	3.83	0.00	0.00	0.00	0.00	0.07
WetShrub100	0.00	0.00	0.00	2.92	6.68	0.00	0.00	0.00	1.97	6.93
WetShrub150	0.00	0.00	0.08	3.50	6.53	0.00	0.00	0.00	2.01	5.90
WetShrub300	0.00	0.00	1.44	3.58	6.43	0.00	0.00	0.47	2.75	5.27
WetShrub50	0.00	0.00	0.00	2.29	7.02	0.00	0.00	0.00	1.50	7.92

Appendix D8. Land Cover in Island County Wetlands in 1998 and 1992 as Derived From Satellite Imagery

At coarse spatial resolution, the 1992 and 1998 satellite images of Island County indicate the land cover at those times in the County. They present a general picture of the context of wetland occurrence in Island County during those two years. However, little information is available regarding definitions of these land cover classes, which were obtained from a secondary source. Because the land cover classes used in the interpretation of the imagery from those two years were not equivalent, and the interpretations have not been field-verified, no inference can be made regarding *when* during the intervening six years any apparent changes in land cover occurred.

Table D8.1. Satellite-derived 1992 land cover classes as mapped in Island County wetlands

Land Cover Class*	# of wetlands	% of wetlands
Forest Deciduous	258	26.93%
Forest Mixed	200	20.88%
Forest Evergreen	155	16.18%
Pasture or Hayfield	153	15.97%
Developed Low Density	49	5.11%
Shrubland	32	3.34%
Grass Short	27	2.82%
Develop Medium Density	23	2.40%
Open Water	23	2.40%
Dunes & Rock	12	1.25%
Orchards	7	0.73%
Successional Vegetation	7	0.73%
Grassland	6	0.63%
Forested Wetland	5	0.52%
Grains	1	0.10%

* only each wetland's most extensive class was counted

Table D8.2 Satellite-derived 1998 land cover classes as mapped in Island County wetlands

Land Cover Class:	# of wetlands	% of wetlands
Grass Short	177	18.48%
Shrub Deciduous	105	10.96%
Shrub-Ag Mixed	91	9.50%
Shrub & Grass	70	7.31%
Rural Lawn	69	7.20%
Shrub & Forest	67	6.99%
Forest Evergreen Open	64	6.68%
Developed Low Density	56	5.85%
Grass Sparse	32	3.34%
Wetland (emergent & shrub)	26	2.71%
Developed High Density	24	2.51%
Shrubs- Evergreen	24	2.51%
Forest Mixed	22	2.30%
Forest Open with Shrubs	20	2.09%
Wetland (shrub)	19	1.98%
Grass Urban	15	1.57%
Developed Low Density w. Shrub	14	1.46%

Land Cover Class:	# of wetlands	% of wetlands
Open Water (shallow)	12	1.25%
Open Water	12	1.25%
Wetland (emergent non-estuarine)	7	0.73%
Shrubs Urban	5	0.52%
Forest Deciduous	4	0.42%
Forest Shrub & Grass	4	0.42%
Developed Low Density w. Grass	3	0.31%
Mowed	3	0.31%
Riparian Vegetation	3	0.31%
Wetland (emergent estuarine)	3	0.31%
Wetland (forested)	2	0.21%
Forest Evergreen	1	0.10%

* only each wetland's most extensive class was counted

Table D8.3. The dominant land cover class in zones *surrounding* Island County wetlands, from 1998 satellite imagery

	# of wetlands where dominates in 0-50 ft zone	# of wetlands where dominates in 50-100 ft zone	# of wetlands where dominates in 100-150 ft zone	# of wetlands where dominates in 150-300 ft zone	# of wetlands where dominates (average of zones)	% of wetlands
DevelHiDens	27	24	27	29	27	2.79%
DevelLoDenGrass	6	6	7	5	6	0.63%
DevelLoDenSS	25	18	13	12	17	1.77%
DevelLoDens	50	48	38	40	44	4.59%
ForestDecid	5	3	1	0	2	0.23%
ForestEvgr	0	3	0	0	1	0.08%
ForestEvgrOpen	70	74	76	87	77	8.01%
ForestMix	12	7	8	3	8	0.78%
ForestOpenSS	10	9	9	10	10	0.99%
ForestSSgrass	2	1	2	1	2	0.16%
GrassShort	206	233	252	259	238	24.79%
GrassSparse	36	34	36	31	34	3.58%
GrassUrban	12	12	7	10	10	1.07%
Mowed	2	2	0	0	1	0.10%
OWshallow	5	3	2	4	4	0.37%
OpenWater	5	11	13	30	15	1.54%
RiparVeg	6	0	0	0	2	0.16%
RuralLawn	66	66	60	46	60	6.21%
ShrubAgMix	103	108	126	121	115	11.95%
ShrubDecid	122	134	131	153	135	14.09%
ShrubEvgr	21	16	24	28	22	2.32%
ShrubForest	70	73	59	54	64	6.68%
ShrubGrass	66	49	41	26	46	4.75%
ShrubUrban	3	4	6	5	5	0.47%
WetEmEst	2	1	3	1	2	0.18%
WetEmForest	0	1	0	0	0	0.03%
WetEmNonEst	4	6	2	0	3	0.31%
WetEmSS	10	9	8	2	7	0.76%
WetForest	1	0	1	0	1	0.05%
WetShrub	10	3	5	1	5	0.50%

Appendix D9. Extent of Soils in Wetlands vs. Non-wetlands, as Indicated by the NRCS Soil Survey for Island County

Bolded soils (column 1) are proportionally more prevalent in wetland than non-wetland areas. Asterisk (*) in the second column indicates non-hydric soils that sometimes have localized hydric inclusions.

Soil Map Code	Hydric?	Peat/ Muck?	Clay?	% of All Wetland Acres	% of All Non-Wetland Acres	Acres in Wetlands	Acres in Non-Wetlands	Acres in Wetland Contributing Areas	Total Island County Acres	% of Contributing Area Soils	% of Island County Soils
Aa	no*	no	no	0.04	0.08	5.20	96.86	35.12	102.07	0.28	0.08
Ab	no*	no	no	0.07	0.83	10.57	981.80	301.14	992.36	2.42	0.75
Ac	no	no	no	0.00	0.05	0.00	54.59	0.00	54.59	0.00	0.04
Ad	no*	no	no	0.01	0.27	1.27	324.84	757.07	326.11	6.08	0.25
Ae	no*	no	no	1.56	7.21	219.60	8562.72	13081.17	8782.33	105.08	6.62
Af	no*	no	no	0.96	2.02	135.02	2397.37	3174.09	2532.39	25.50	1.91
Ba	Yes	no	no	**1.97**	0.88	277.67	1048.54	2247.14	1326.21	18.05	1.00
Bb	Yes	no	no	0.30	1.59	42.24	1889.95	2257.82	1932.19	18.14	1.46
Bc	Yes	no	no	0.35	0.77	49.46	909.78	1273.41	959.24	10.23	0.72
Bd	no	no	no	**0.40**	0.13	56.69	150.55	200.31	207.24	1.61	0.16
Be	no	no	no	0.00	0.07	0.68	88.19	9.01	88.86	0.07	0.07
Ca	Yes	Yes	no	**0.81**	0.07	114.16	83.45	512.73	197.61	4.12	0.15
Cb	no	no	no	0.36	0.65	51.43	769.32	764.09	820.76	6.14	0.62
Cc	no*	no	no	0.11	0.19	16.10	225.11	236.26	241.21	1.90	0.18
Cd	no	no	no	0.01	0.01	2.07	9.85	3.39	11.92	0.03	0.01
Ce	no	no	no	0.78	1.50	110.13	1776.03	2475.10	1886.16	19.88	1.42
Cf	no	no	no	0.22	0.61	30.87	724.75	381.40	755.61	3.06	0.57
Cg	no	no	no	0.09	0.09	12.51	103.84	82.67	116.34	0.66	0.09
Ch	no	no	no	**5.87**	0.58	827.92	694.08	472.30	1521.99	3.79	1.15
Ck	Yes	no	no	**4.18**	0.27	589.97	324.18	997.89	914.15	8.02	0.69
Cm	Yes	no	no	**1.76**	0.17	248.21	197.07	554.48	445.28	4.45	0.34
Cn	Yes	no	no	**1.91**	1.36	269.78	1609.77	1998.87	1879.55	16.06	1.42
Co	Yes	no	no	0.04	0.11	5.40	135.56	27.14	140.96	0.22	0.11
Ea	no*	no	no	**3.57**	0.20	504.03	241.82	856.52	745.86	6.88	0.56
Eb	no*	no	no	**0.10**	0.01	14.22	7.49	18.45	21.71	0.15	0.02
Ec	no	no	no	0.04	0.06	6.07	65.30	56.82	71.37	0.46	0.05
Ed	no	no	no	0.37	0.96	52.75	1134.95	711.08	1187.70	5.71	0.90
Ee	no	no	no	0.47	0.93	66.08	1109.81	2179.27	1175.89	17.51	0.89
Fa	Yes	no	no	**0.47**	0.01	66.20	9.01	139.49	75.21	1.12	0.06

Soil Map Code	Hydric?	Peat/ Muck?	Clay?	% of All Wetland Acres	% of All Non-Wetland Acres	Acres in Wetlands	Acres in Non-Wetlands	Acres in Wetland Contributing Areas	Total Island County Acres	% of Contributing Area Soils	% of Island County Soils
Ga	Yes	Yes	no	**0.37**	0.01	52.22	12.19	160.12	64.40	1.29	0.05
Ha	Yes	no	no	**1.47**	0.13	207.55	159.00	282.15	366.55	2.27	0.28
Hb	no	no	no	1.33	1.35	187.23	1607.75	2006.53	1794.99	16.12	1.35
Hc	no	no	no	0.44	0.61	62.21	721.65	674.38	783.86	5.42	0.59
Hd	no	no	no	0.04	0.05	5.92	61.60	121.41	67.52	0.98	0.05
He	no	no	no	1.39	1.44	196.67	1713.77	2385.34	1910.44	19.16	1.44
Hf	no*	no	no	4.14	9.27	584.47	11008.64	21592.45	11593.10	173.45	8.74
Hg	no	no	no	0.36	1.83	51.21	2171.86	838.59	2223.06	6.74	1.68
Ia	no	no	no	0.06	0.20	7.87	231.77	65.87	239.63	0.53	0.18
Ib	no	no	no	0.31	1.97	43.92	2337.33	708.02	2381.25	5.69	1.80
Ic	no	no	no	0.20	1.14	28.71	1356.59	516.74	1385.30	4.15	1.04
Ka	no	no	no	**0.19**	0.16	27.21	193.40	302.03	220.61	2.43	0.17
Kb	no	no	no	**1.54**	1.27	217.49	1504.67	2086.67	1722.16	16.76	1.30
Kc	no*	no	no	2.83	5.85	399.48	6945.81	9500.14	7345.28	76.31	5.54
Kd	no*	no	no	0.83	5.47	116.93	6490.73	8058.62	6607.66	64.73	4.98
Ke	no	no	no	0.04	0.22	5.73	261.86	546.50	267.59	4.39	0.20
La	Yes	no	no	**1.02**	0.07	144.04	84.71	314.91	228.75	2.53	0.17
Lb	Yes	no	no	**3.46**	0.43	487.87	504.91	754.90	992.79	6.06	0.75
Lc	Yes	no	Yes	**0.95**	0.04	134.76	52.60	248.37	187.36	2.00	0.14
Ma	no	no	no	**0.59**	0.48	82.60	570.12	221.47	652.72	1.78	0.49
Mb	Yes	Yes	no	**4.77**	0.13	672.82	152.25	2241.11	825.08	18.00	0.62
Mc	Yes	Yes	no	**0.11**	0.01	16.19	11.60	37.04	27.79	0.30	0.02
Na	Yes	no	no	**2.69**	0.71	378.99	847.32	2241.37	1226.31	18.00	0.92
Nb	Yes	no	no	0.07	0.16	9.51	195.06	120.90	204.57	0.97	0.15
Nc	Yes	no	no	**1.43**	0.47	201.82	552.76	1303.53	754.58	10.47	0.57
Pa	no	no	no	0.00	0.11	0.00	127.40	0.00	127.40	0.00	0.10
Pb	Yes	no	Yes	**0.20**	0.14	27.78	164.77	46.18	192.55	0.37	0.15
Ra	Yes	Yes	no	**1.61**	0.21	226.61	244.00	832.51	470.61	6.69	0.35
Rb	Yes	Yes	no	**0.70**	0.13	98.46	148.86	354.26	247.32	2.85	0.19
Rc	no*	no	no	**2.41**	1.52	340.10	1805.93	226.38	2146.03	1.82	1.62
Rd	no	no	no	0.05	0.17	6.78	206.42	26.19	213.21	0.21	0.16
Sa	no	no	no	**3.34**	0.27	471.37	316.92	1179.40	788.29	9.47	0.59
Sb	no	no	no	0.03	0.15	3.57	175.91	153.38	179.48	1.23	0.14
Sc	Yes	Yes	no	**2.30**	0.14	324.69	162.69	1456.87	487.38	11.70	0.37
Sd	Yes	Yes	no	**0.56**	0.05	79.68	62.69	296.04	142.37	2.38	0.11
Se	no*	no	no	**0.86**	0.30	121.95	359.29	660.83	481.24	5.31	0.36

Soil Map Code	Hydric?	Peat/ Muck?	Clay?	% of All Wetland Acres	% of All Non-Wetland Acres	Acres in Wetlands	Acres in Non-Wetlands	Acres in Wetland Contributing Areas	Total Island County Acres	% of Contributing Area Soils	% of Island County Soils
Sf	no	no	no	0.01	0.02	1.30	28.88		30.18	0.00	0.02
Sg	no*	no	no	0.86	1.49	121.84	1771.99	4276.83	1893.83	34.35	1.43
Sh	no	no	no	1.27	1.49	178.67	1763.25	3108.57	1941.92	24.97	1.46
Sk	no*	no	no	**0.18**	0.16	26.02	195.17	609.15	221.19	4.89	0.17
Sm	no*	no	no	0.00	0.17	0.17	200.80	10.00	200.97	0.08	0.15
Ta	Yes	Yes	no	**1.95**	0.02	275.78	26.06	294.85	301.83	2.37	0.23
Tb	Yes	Yes	no	**2.26**	0.14	319.54	160.28	1020.52	479.82	8.20	0.36
Tc	Yes	Yes	no	**0.08**	0.03	11.30	31.23	59.72	42.53	0.48	0.03
Td	Yes	no	no	**6.11**	0.00	862.33	0.00	557.35	677.03	4.48	0.51
Te	no*	no	no	0.57	0.90	79.89	1063.02	1816.81	1142.92	14.59	0.86
Tf	no*	no	no	0.49	0.58	69.11	686.85	405.89	755.96	3.26	0.57
Tg	no	no	no	**0.11**	0.01	16.21	8.04	21.06	24.25	0.17	0.02
W	Yes	no	no	**8.03**	0.00	1133.74	0.00	1586.81	1104.88	12.75	0.83
Wa	no*	no	no	0.34	0.48	48.68	566.82	1128.86	615.49	9.07	0.46
Wb	no*	no	no	7.08	32.07	998.85	38072.81	62351.56	39071.66	500.85	29.46
Wc	no*	no	no	1.13	4.12	159.06	4894.26	6996.65	5053.32	56.20	3.81

Appendix D10. Correlations of Most Frequent Plant Species with Several Disturbance Variables

See Data Dictionary (Appendix B) for definitions of disturbance variables and plant species codes
■ indicates positive ($p<0.05$) Spearman rank correlation, i.e., occurred mainly at sites with greater extent and/or more recent occurrence of the disturbance variable
* indicates negative ($p<0.05$) Spearman rank correlation, i.e., species occurred mainly at sites with little or no occurrence of the disturbance variable
Empty cell indicates lack of significant correlation

Plant Species	Dscore	Dscore InclVeg	GeoAlt Extent	Linear Alteration	Veg Alteration	Impv Edge %	InWetl Clearing	InWet Buildings	InWetland Road	InWetland Pond	Buffer Alteration	Surroundings Alt	Burned	Logged	Ditched	Grazed	Lawn /Pasture	Mowed	Fert ilizer / Spray	Excavation	Road	Vehicle Tracks	Stormwatr
AGCA						■	■		■			■											
AGGI		■			■										■	■		■					
ALRU		*		*				■					■										
ANOD																		■					
AREG	■	■	■	■	■							*											
ATFI	*	*			*			■															
ATPA						■																	
CADE						*																	
CIAR	■	■			■			◊					*		■			■	■				
CIVU	■	■	■		■												■	■					
DISP						■																	
ELPA	■	■	■	■																■			
ELRE																			■				
EQAR	■		■	■						■				*									
EQTE		*			*									■									
FEAR	■	■			■											■	■	■	■	■			
GASH								■		■	■	■		*			*	*					
GEMA																					■		
GLEL													■										
GRIN																*							
HOLA	■	■			■										■	■	■	■	■				
HYRA		■			■											■	■	■	■				
ILAQ	*	*			*					■				*				*					
JACA				■																			
JUBA												*			■						■		
JUEF												■				■	■	■					

Plant Species	Dscore	Dscore InclVeg	GeoAlt Extent	Linear Alteration	Veg Alteration	Impv Edge %	InWetl Clearing	InWet Buildings	InWetland Road	InWetland Pond	Buffer Alteration	Surroundings Alt	Burned	Logged	Ditched	Grazed	Lawn /Pasture	Mowed	Fert ilizer / Spray	Excavation	Road	Vehicle Tracks	Stormwatr
LOIN															■	■	■					■	
LYAM	*	*	*	*	*							■						*		*			
MAFU										■													
MEAR														*							*		
MYLA				■																■			
NULU		*	*	*	*	*															*		
OESA	*	*	*	*	*	*							■		*	*	*	*					
PHAR						■										■	■	■		■		■	
PISI													■										
PLLA	■	■			■	■	■											■		*			
PLMAR																*							
POMU									■								*	*					
POPA			*									■											■
PSME													■										
PTAQ													■										
RARE									■														
RINA						*		■						*				*					
RUCR	■	■	■		■										■		■	■	■	■		■	
RULA	*		*	*									■							*			■
RUOB																				■			
RUSP		*																	*			*	
RUUR							■																
SALU														*									
SARA				*	*			■											*				
SASC																■	■			■			
SASI		■			■												■						
SAVI																*							
SCAC						■									■								
SOAS		■			■						■				■		■			■			
SODU								■						*									■
SPDO	*	*	*	*	*							■											
STCH							■								■								
SYAL										■													

Plant Species	THPL	TOME	TRRE	TSHE	TYLA	URDI	VAPA	VEAM	VESC
Stormwatr									
Vehicle Tracks			■						
Road				■					
Excavation				*			*		
Fert ilizer / Spray						*			
Mowed			■				*		
Lawn /Pasture			■	*			*		
Grazed			■	*			*		
Ditched							*		
Logged		*			*		*	*	*
Burned	■			■					
Surroundings Alt	■								■
Buffer Alteration									
InWetland Pond									
InWetland Road	■						■		
InWet Buildings							■		
InWetl Clearing									
Impv Edge %						*			
Veg Alteration	*		■	*			*		
Linear Alteration	*			*		*	*		
GeoAlt Extent	*								
Dscore InclVeg	*		■	*			*		
Dscore	*			*					